AIR ENGINEERING

MARCH, 1960

AIR POLLUTION CONTROL • AIR MOVING • AIR CONDITIONING

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- *How $8500 Ventilating System Saved $25,000 In 90 Days*
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- *Easy Way To Calculate Heat Flow Through Ductwork*
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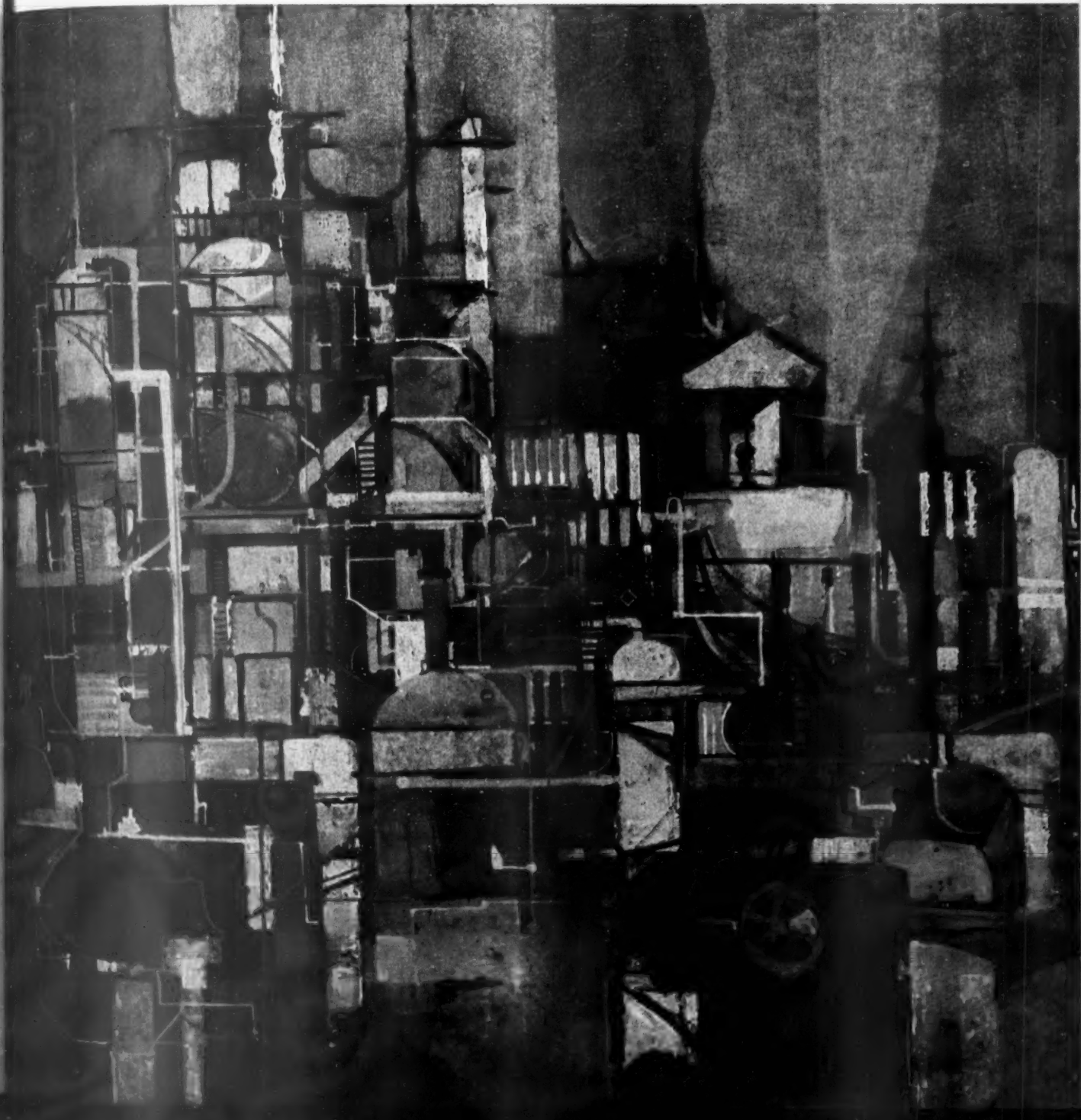

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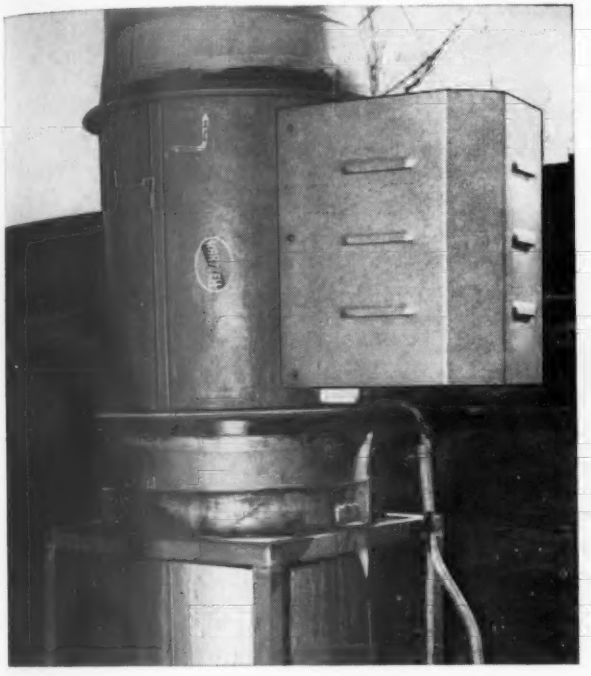
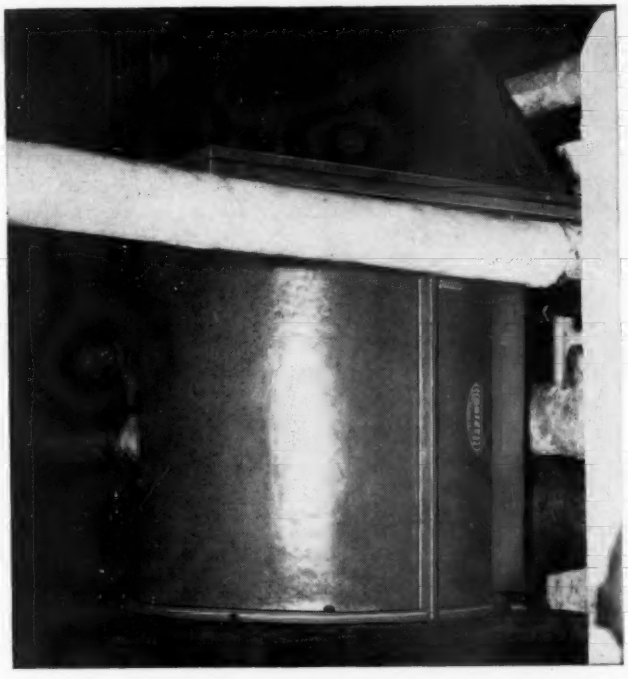
UNSURPASSED RESISTANCE TO CORROSION

...and at a cost substantially below that of stainless steel or monel construction



At the Paramount Plating Company, Newark, N. J. this Hartzell fiberglass duct fan exhausts fumes from over a vat containing 90% phosphoric and 10% nitric acid at 180°-200°F. In use approximately 30 hours a week for well over a year, the fan is still as good as new. And corrosion damage within the plant has been sharply curtailed.



At the Verona Pharma Chemical Company, Newark, N. J. this Hartzell fiberglass duct fan draws fumes off a tank containing hydrochloric acid. Fan runs eight hours a day in conditions so corrosive that the motor has to be mounted outside the building, but it shows no signs of deterioration after nearly two years of service.

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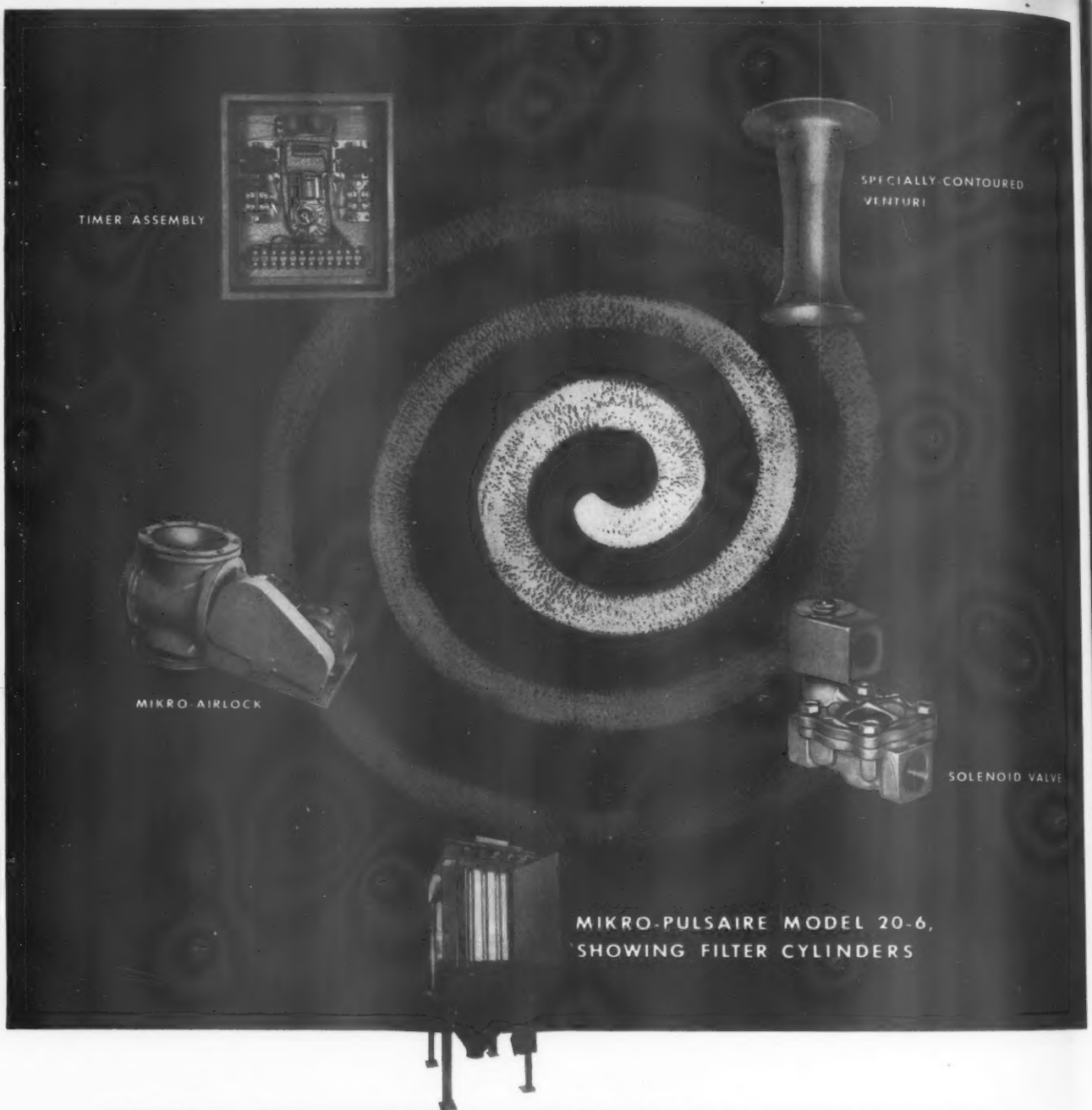

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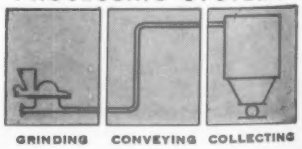

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AIR ENGINEERING

VOL. 2, NO. 3

MARCH, 1960

DEDICATED TO THE SCIENCE OF AIR POLLUTION CONTROL
AIR MOVING • AIR CONDITIONING

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A valuable reference tool for air engineers

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COVER

Cover artwork this month comes from Minnesota Mining and Manufacturing Corp., and depicts a chemical processing plant in operation. Our thanks to **3M** *for a fine cover subject.*

AIR ENGINEERING is published monthly by Business News Publishing Company, at 450 West Fort Street, Detroit 26, Michigan. Subscription prices: United States, Canada: $3.00—1 year; $4.50—2 years; $6.00—3 years. Foreign: $5.00—1 year; $8.50—2 years; $12.00—3 years. Single copies 50 cents. Application to mail at second-class postage rates is pending at Detroit, Michigan. First issue April, 1959. • CHANGE OF ADDRESS. Notify AIR ENGINEERING and your local post-office of both your old and new addresses including postal zone numbers by 12th of preceding month.

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Pollution Complaints

Youngstown, Ohio — Hydrogen sulfide emissions, allegedly from Campbell works of Youngstown Sheet & Tube Co., discolored houses in Campbell and Struthers.

• • •

Birmingham, Ala. — Dust from two cement plants in the Birmingham, Tarrant and Fultondale area is said by local residents to be causing health and property damage. Attorney Frank James is spokesman for a citizen's group making complaint.

• • •

Pocatello, Idaho — Idaho Supreme Court was advised that if a District Court order is not reversed, the J. R. Simplot Co., fertilizer plant, will be forced to close. Nightclub operator near the plant brought action alleging odors, smoke and dust drifted onto club premises, preventing its operation.

• • •

Chicago — Persons becoming ill in Chicago's famed lake-front Furniture Mart from toxic combustion gases said to come from nearby Abbott Hall, Northwestern University dormitory, have started a drive to seek an end to this pollution source. John Sanderson, University director of plant properties, is said to be working toward a solution of the problem.

• • •

Rico, Colo.—From the Rico Argentine acid plant, sulphur fume smogs are said to cause tree damage, lung impairment, reduce visibility to 20 ft., corrode metals. Plant machinery breakdown was also attributed to acid fumes. Precipitator installed was said not to have solved the problem. Plant makes suphuric acid.

Use Communications Center, page 37, for requesting more information about articles, advertised products, literature, and for comments about any of the editorial material in this issue of AIR ENGINEERING.

If you wish to contact manufacturers directly, street addresses are given. But please mention you saw it in AIR ENGINEERING.

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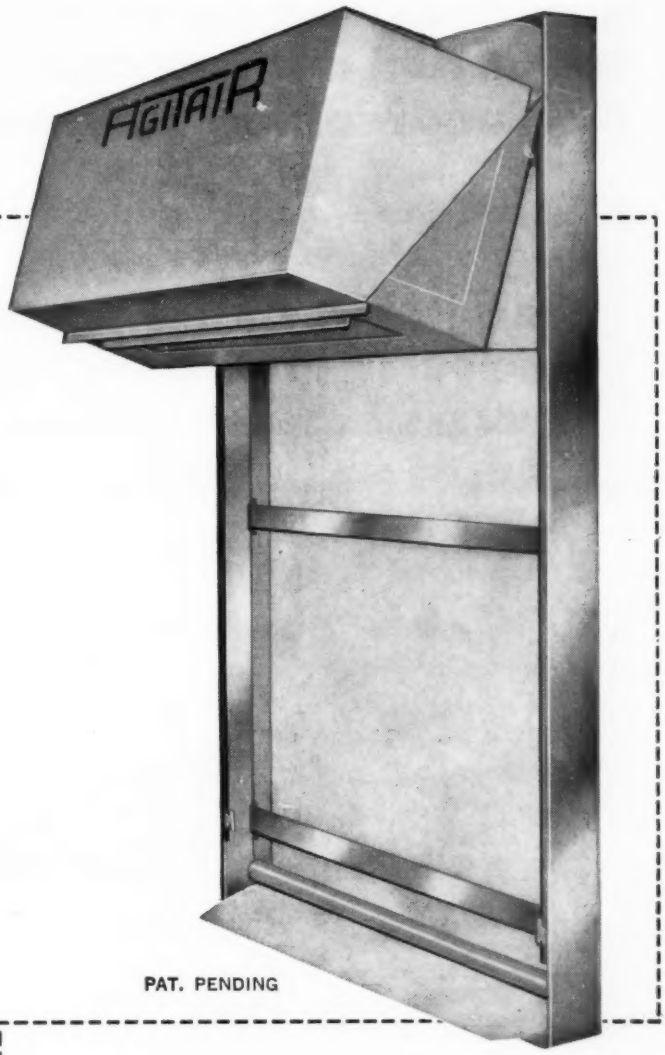

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AGITAIR Type DS Pull-Down filters are engineered to assure the user high dust holding capacity . . . uniform filtering efficiency over the active length of the media with a savings in installation and maintenance costs.

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AGITAIR Type DS Pull-Down filters are available in a variety of sizes and capacities to meet your air filtration requirements. For complete data on these units, ask your AGITAIR representative for technical catalog DS-100 or write direct to Air Devices Inc.

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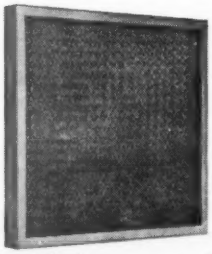
HIGH VELOCITY
TYPE "FM"

Permanent, cleanable all metal construction. Large dust holding capacity and low resistance. Recommended velocity 533 fpm. Made in 1", 2", 4" thickness. Catalog available.



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Watch For These Articles Next Month!

✓ WHAT'S NEW IN AIR SANITATION

This authoritative article will review and comment on the methods used to combat spread of disease by air-borne droplets. Use of ultra-violet lamps, sprays of various types, water and lithium chloride wash, filters of various types, relative humidity control, will be described. For all air engineers concerned with air distribution in hospitals, office buildings, wherever people work.

✓ EASY WAY TO DETERMINE AIR CONTAMINANTS

This simple chart and method will enable you to keep track of degree of contamination within enclosed spaces both as a continuing check of personnel exposure and check of flammable or explosive conditions.

✓ NOISE AND VIBRATION CONTROL IN AIR DISTRIBUTION SYSTEMS

A report on methods of controlling noise caused by air movement and equipment vibration. A "Data Sheet" on the subject to be clipped and saved by air engineers.

We Want Cover Artwork

Attention all artists and photographers! We are searching for unusual and interesting drawings of an interpretive nature (see April, May, October and December covers) for front cover use in Air Engineering.

We are also interested in black and white and full color photos and transparencies, for possible use.

If you have a drawing or photo you think may be suitable, send your selection to us.

You will of course receive full credit for any cover material used.

AIR ENGINEERING

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EDITORIAL:

Smog Causes Cancer!

WE'VE SUSPECTED IT. Now we have expert testimony. Air Pollution is cancer's precursor and procurer!

Dr. Wilhelm C. Hueber, Nobel-Prize-winning director of the National Cancer Institute in Bethesda, Md., reports that most recent research studies blame smog-laden air – polluted by industrial wastes and auto exhausts – at the No. 1 cause of lung cancer in the world.

Industrialization probably is contributing to the rolling tool of *other* kinds of cancer, too, he believes.

Small amounts of cancer-causing agents can be found in cigarette smoke, to be sure, and there is evidence to suggest that tobacco particles are irritants which interfere with our lungs' natural defenses against carcinogens in polluted air.

However, an upsurge in lung cancer arose between 1900 and 1920 – long before cigarette smoking became widespread.

Today, lung cancer is most frequent in those large cities which suffer the most industrial pollution. And, to cap his argument, air pollutants from that American city which suffers the highest incidence of lung cancer, registers the worst density of air pollution.

Dr. Hueber's theorem has gained additional credence by the release of a massive 10-year examination of New Zealand residents. Definitely, this "controlled" scientific study reveals that polluted air probably is the prime cause of lung cancer.

Emigrants – 250,000 of them – who moved from smoggy, industrial England into the unpolluted atmosphere of pastoral, dairy-farming New Zealand (no smokestacks) provide the evidence.

Those refugees from smoggy British cities were compared with native-born New Zealanders by Dr. David F. Eastcott. For a "control factor" he had two virtually identical populations – socialogically speaking.

Both emigrants and native-born possessed equivalent constitutional or hereditary make-up, led almost the same way of life, and their eating and smoking habits were practically identical, too.

Incidence of cancer was 30 per cent higher among the newcomers from urbanized and industrialized England than among New Zealand's 2.3 million native-born pastoral citizens, Dr. Eastcott discovered.

Among these Britons who voyaged to New Zealand relatively late in life – after living in smoggy England for 30 years or more – the prevalence of

(Please turn to following page)

Editorial (Cont.)

Smog Causes Cancer!

(Continued from preceding page)

lung cancer was 75 per cent above that which obtains for native New Zealanders in a similar age bracket, he also reports.

Thereafter Dr. Eastcott (endeavoring to nail down his discovery beyond the proverbial "shadow of a doubt") studied a group which had moved from Birmingham (England's Pittsburgh) to New Zealand 25 to 30 years ago, and compared it with a similar age group of native-born New Zealanders.

Although those latter immigrants had breathed polluted air early in life, and then enjoyed lungfulls of pure air for their later years, their cancer hazard was 20 to 30 per cent greater than that suffered by lifelong residents of Auckland or Christchurch.

The conclusion is inescapable, Dr. Eastcott avers. Lung cancer is a product of total environment – in which polluted air plays a major role.

"Atmospheric pollution," he affixes, "operates directly. It infuses carcinogenic (cancer-causing) substances which are taken up by lung tissue. And it operates indirectly by increasing the incidence of bronchitis, which is a precursor of cancerous changes in the lungs."

There we are. Q.E.D. Air pollution causes cancer. What can we do about it – you and I?

First thing that comes to mind is political action by the Federal Government. Factory managers and automobile designers, it will be argued, won't do a darned thing about it unless compelled.

In our past history we can point with chagrin to the Robber Barons of the railroads. It took Federal Control to bring them to heel, you say? Uh-huh. And look at the pitiful plight of the railroads now....

Surely it would seem that *enlightened self-interest* would encourage directors of factory enterprises to control their own smog before the Government finds another way to control them.

Moreover, clean air is just as important (maybe more!) *inside* the plant. Factory managers should study each new process in the light of its effect on air purity.

Managers, too, may be inhaling cancer, incidentally. ▲▲

Meetings, Courses, Expositions

National Association of Corrosion Engineers annual conference and corrosion show, *Memorial Auditorium, Dallas, March 14-18.*

Mid-Atlantic States Air Pollution Control Association special conference on gaseous industrial waste problems, *Hotel Traymore, Atlantic City, March 29.*

23rd National Oil Heat & Air Conditioning Exposition sponsored by Oil Heat Institute of America, *Coliseum, New York City, April 3-7.*

Oil Heat Institute of America, 38th annual convention, *Park-Sheraton hotel, New York City, April 3-7.*

U. S. Public Health Service course on "Atmospheric and Source Sampling," *Robert A. Taft Sanitary Engineering Center, Cincinnati, April 4-15.*

Building Research Institute Spring conference, *Statler-Hilton hotel, New York City, April 5-7.*

Instrument Society of America, 3rd national chemical and petroleum instrumentation symposium, *Rochester, N. Y., April 5-7.*

American Chemical Society, 137th national meeting, *Cleveland, April 5-14.*

Institute of Environmental Sciences annual national meeting, *Biltmore hotel, Los Angeles, April 6-8.*

Stanford Research Institute symposium on chemical reactions in the lower and upper atmosphere, *Mark Hopkins hotel, San Francisco, April 18-20.*

U. S. Public Health Service course on "Analysis of Atmospheric Inorganics," *Robert A. Taft Sanitary Engineering Center, Cincinnati, April 25-29.*

American Society of Industrial Hygiene annual meeting, *War Memorial building, Rochester, N. Y., April 25-28.*

3rd Western Refrigeration, Air Conditioning, Heating, and Ventilating Exposition, *Shrine Exposition Hall, Los Angeles, April 27-30.*

Air-Conditioning and Refrigeration Institute annual meeting, *Hot Springs, Va., May 1-4.*

U. S. Public Health Service course on "Analysis of Atmospheric Organics," *Robert A. Taft Sanitary Engineering Center, Cincinnati, May 2-6.*

Instrument Society of America, second Instrument - Automation conference and exhibit, *Civic Auditorium and Brooks Hall, San Francisco, May 9-12.*

Postgraduate course in "Effects of Air Pollution and Environment on Health" for engineers, physicians, educators. *Wisconsin Center Bldg., University of Wisconsin, Madison, Wis., May 19-20.*

Industrial Heating Equipment Association, Inc., *The Homestead, Hot Springs, Va., May 22-25.*

Air Pollution Control Association 53rd annual meeting, *Netherland-Hilton hotel, Cincinnati, May 22-26.*

Industrial Ventilation Conference Outstanding Success

For the ninth successive year, the annual Industrial Ventilation Conference at East Lansing, Mich., sponsored by Michigan's Division of Occupational Health and by Michigan State University, drew a capacity registration of some 250 air engineers from nearly every state in the Union.

At an open forum discussion, participants discussed polyurethane plastics ventilation, industrial waste heat reclamation, air quality control in beryllium tooling plants, factory air conditioning, cement mill dust control, dozens of other subjects in air engineering.

In addition to daily basic and advanced classes in industrial ventilation, talks were given on heat reclamation, principles of air flow, design of industrial ventilation hoods, controls for make-up air units and distribution of make-up air.

Air engineers have another chance to attend a similar meeting March 21-24 at North Carolina State College, in Raleigh.

Fall-Out Shelters Next Major Market For Air Quality Control Equipment?

If every public building, factory, residence and institution were to be equipped with fall-out shelters, there would unquestionably be a brisk demand for air conditioners, portable power plants, sub-micron filters, blowers, dampers, and similar items. If New York's Governor Rockefeller has his way, this may come to pass.

The Governors Conference, headed by Governor Rockefeller, at an all-day meeting at the White House, heard reports from heads of Federal Departments on necessity of fall-out shelters to a successful defense and foreign policy. It concluded that a state-operated shelter construction program with Federal aid was essential and financially feasible.

And President Eisenhower's position was made clear in a White House statement recalling the President's position as first spelled out in May, 1958: "In event of nuclear attack on this country, fall-out shelters offer the best single non-military defense measure for the greatest number of our people."

Expansion At Polymer Includes Air Quality Control

Polymer Corporation, Ltd., Sarnia, Ont., Canada, has earmarked $4,700,000 for capital items related to improvement of production units, including prevention of air pollution, according to E. R. Rowzee, president and managing director.

Engineering Quacks, Get Ready To Duck!

Miss Vera Binks, Director of the Department of Registration and Education of the State of Illinois, has indicated that her Department is investigating the problem of "engineering quacks."

Miss Binks points out that anyone offering engineering service in Illinois . . . any person or firms using the title "Engineer" or offering engineering service . . . must clearly indicate who the legally qualified person or persons are, if other than principal of the firm.

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where cloth is the RIGHT answer . . .
Dustex engineering eliminates usual cloth problems
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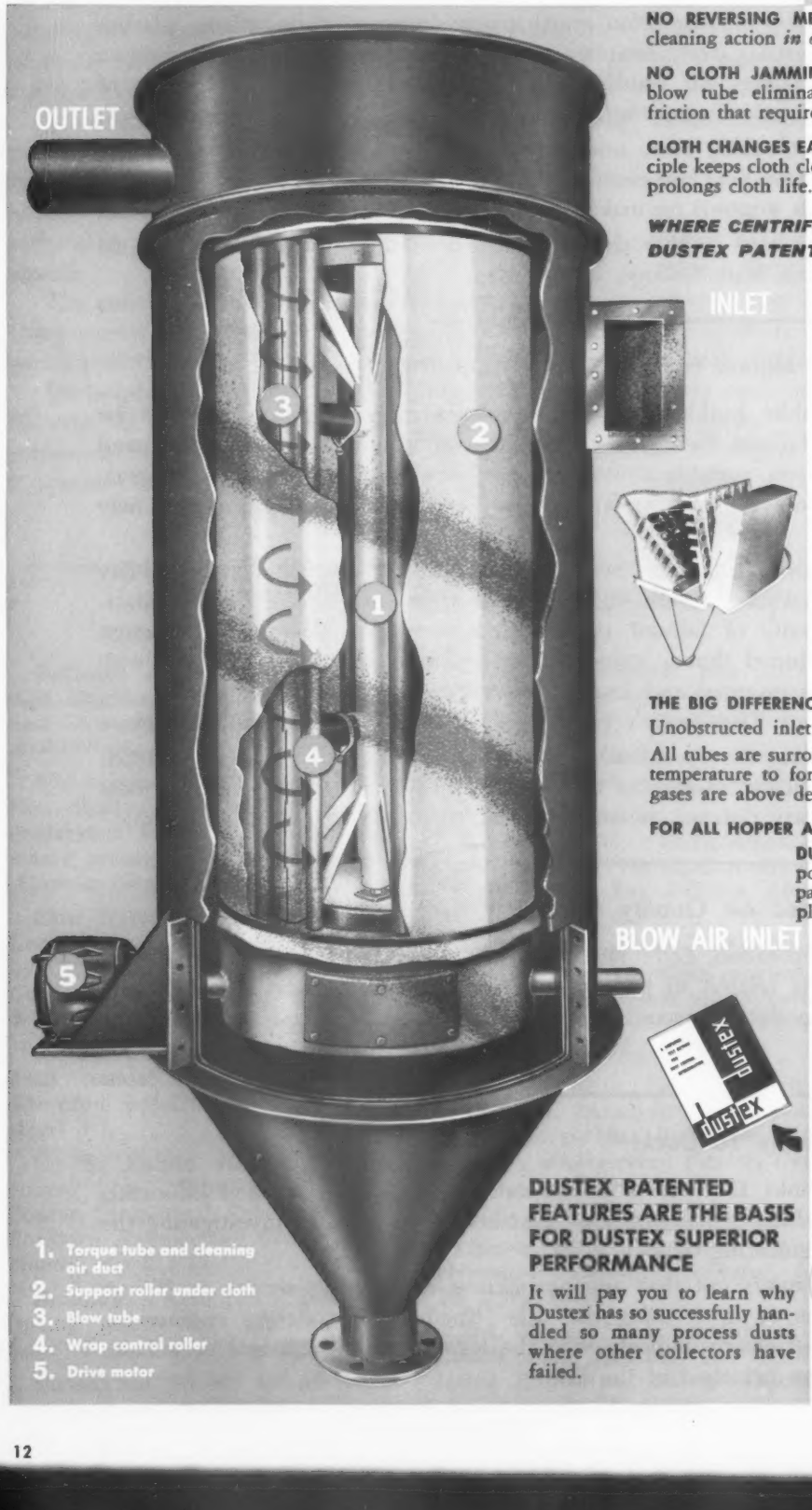

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3. Blow tube
4. Wrap control roller
5. Drive motor

NO REVERSING MECHANISMS — Ingenious, simplified, continuous cleaning action *in operation.*

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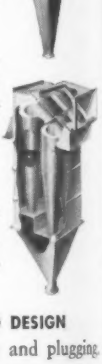

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NEWS of the Industry

Negative Ions

One of Medicine's Newest Weapons

"Negative Ions for Everybody?" was the title of a rather lengthy article on the subject in a recent issue of *Business Week*. The heading further stated that "Research tests indicate that negative ions ... make burns heal more quickly, with less pain . . . produce tranquilizing effect on mental patients . . . slow growth of lung cancer in mice."

"The amazing array of accomplishments above has been claimed by researchers for one of medicine's newest weapons—negative ions," the article began. "Last week, scientists at General Electric Co.'s Lamp Research Center were talking about the development of a new system to produce negative ions synthetically and economically. Their announcement was the latest outcropping of a continuous interest in the effects of ions on man.

"On the basis of evidence already accumulated, scientists seem at least half convinced that an atmosphere rich in negative ions can work wonders on all sorts of ailments."

The report on how cancer patients may benefit from a heavy artificially produced concentration of negative ions was news, even to many who had followed research in this field. According to *Business Week*, in a series of tests run by Dr. Walter H. Eddy, formerly of Columbia university, 60 mice of a breed especially susceptible to lung cancer were separated into two equal groups. One group was kept in ordinary atmosphere, the other in a room with a high negative ion content. At the end of two months, 22 of the 30 mice living in ordinary air had developed lung malignancies and died. Of the other group only two died; the rest showed no signs of lung cancer.

Dr. Eddy's results, says the article, have been spectacular enough to catch the eye of a number of important medical authorities. The American College of Chest Physicians has set up a committee to probe the value of negative ions in treatment of lung cancer.

There has been a gradual improvement in the mechanisms which turn out a reliable supply of negative ions, it is said, and this has improved the results in the field of medicine. Philco, Emerson Electric, and Michael Electric Co. of New Haven, Conn. were pointed out as firms who had done some of the pioneer work in the field.

Westinghouse, General Electric, and Carrier all have experimental machines to produce negative ions well along in development, but they have not yet decided on full-scale production, the article reported.

. . . May Also Make Auto Exhaust Gas Healthful

Automobile exhaust gas that will be healthful? That's the aim of research now underway at the laboratories of Standard Oil Co. of Ohio.

Positive ions in gasoline exhaust are blamed by many researchers as being a major factor in smog. Much of the effort directed towards decontamination of the exhaust goes into work on developing chemical additives that would neutralize the positive ions.

But Sohio's Chemical & Research Div. is going a step further, working on the development of an attachment for the exhaust pipe that will spray health-giving negative ions into the no-longer polluted air.

Warns Health Problem Expands with Industry

Expansion of industrial facilities without subsequent expansion of facilities to safeguard the health of employes can result in occupational health problems, the Michigan Department of Health points out.

Department engineers, it is reported, were asked to study a brass foundry where dust control equipment had been installed about 10 years ago. At that time it was pouring 300,000 pounds of brass a month, but the monthly output now is 1,000,000 pounds.

The study showed a dangerous dust concentration, because dust control facilities had not been expanded, and the department recommended changes and improvements to correct the problem.

In its report the state health department stated that among new hazards were a process for using mercury in the manufacture of permanent magnets. Old hazards confronted once again in the past year, according to the report, included industrial radiation; carbon monoxide; hydrogen sulfide; the shell molding process in foundries; improperly ventilated schools and public garages; air pollution from power plants, grain elevators, foundries and paper plants; and a host of workroom contaminants.

Executive Floor Gets Own Air Conditioning

Air conditioning being installed for the new building which will house the headquarters of Signal Oil and Gas Co. in downtown Los Angeles has a new wrinkle in that a different type of air conditioning will be provided for the executive offices of the building, located on the sixteenth (top) floor, than that used for the rest of the structure.

The air conditioning system is being designed to provide a maximum 17° F. temperature differential between the inside and outside air. However, the executive offices, utilizing a completely separate air conditioning system, will work on a 20° F. differential.

The "Recold" multizone unit servicing the executive floor provides cooling through a Refrigerant-12 direct expansion system, while the rest of the building is cooled by a chilled water system. Multizone units are placed on the mezzanine, and each odd-numbered floor up to the fifteenth floor.

Three Recold air handling units pull fresh air into the building. Activated charcoal filters are used to eliminate impurities from the outside air.

(Please turn to following page)

NEWS of the Industry . . .

(Continued from preceding page)

261 Sound Traps on Ventilating Ducts Silence 'Grapevine' In Oregon Prison

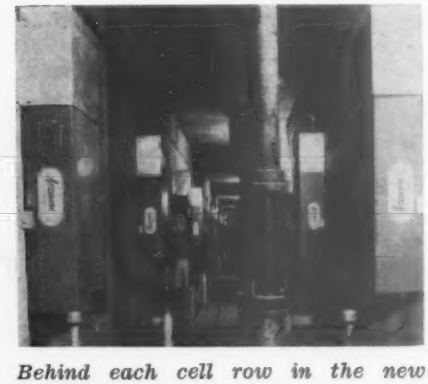
Oldtime inmates of Oregon state prison found the usual means for the prison "grapevine" communication system no longer working when they transferred to the new Oregon State Correctional Institute in Salem. Unique sound traps installed in ventilating ducts have cut off the "grapevine."

At the older Oregon State Penitentiary nearby from which some of the Correctional Institution prisoners came, it seemed that the walls had ears. Ventilating ducts leading from cell to cell formed veritable speaking tubes through which prisoners communicated even when supposedly in "solitary." The ventilating duct "grapevine" was used by convict leaders to promote organized programs of disobedience, even in attempts to stir up riots.

Walls have no "ears" in this prison. Supt. P. J. Squier surveys one of cell blocks in which prison "grapevine" has been silenced. Sound traps allow air to pass through normally but absorb noise so completely that communication through ventilators is impossible.

During planning stages for the new Correctional Institution, state prison officials asked the Portland, Ore. architectural firm of Annand, Boone and Lei to find some way of constructing the ventilating ducts so air would flow through properly but would not carry sound. In conjunction with a consulting engineer, W. Bruce Morrison, the problem was solved with the installation of 261 sound traps, known as "Aircoustats" and made by Koppers Co., Inc.

One "Aircoustat" was installed for each cell. They fit directly into the ventilating ducts. Each is 2 ft. long and contains a scientifically designed array of filter materials and traps which automatically muffle sounds in the high, low and middle frequencies.



Behind each cell row in the new Oregon State Correctional Institution at Salem are the ventilating ducts for each cell. Each contains an Aircoustat to prevent prisoner conversations through the ducts.

New Yorkers Gripe More About Pollution

Complaints by New York City citizens against excessive smoke and other forms of air pollution were 20% more numerous last year than in 1958, the city's Department of Air Pollution reports.

Acting Commissioner Richard A. Wolff said that 17,185 complaints were received last year compared with 14,287 in 1958, setting a new record. The 4,942 violation notices served by the department last year also constituted a new high, the official added. Fines totaling $13,765 were imposed in the Municipal Court as the result of 578 summonses issued to the offenders.

John Wood Sets Up Pollution Control Div.

John Wood Co., manufacturer of petroleum marketing equipment and domestic and industrial water heating and specialty tanks, has organized a new pollution control division. Guy George Gabrielson, president of the company with headquarters in New York City, states that the new division will be located at Bernardsville, N. J.

A staff of engineers and scientists will provide a complete engineering service for the correction of air pollution problems, and the company will also have a line of air pollution control products into production soon, Gabrielson said.

Finds Polluted Air Source of Lung Cancer

A 10-year study of people in New Zealand, done on a massive scale, has convinced a medical researcher that polluted air is a major cause of lung cancer.

Some 250,000 persons who moved from smoggy, industrial England into the unpolluted atmosphere of New Zealand provided the evidence. These newcomers were compared with native-born New Zealanders. The study was made in two five-year periods while Dr. Eastcott was connected with New Zealand's public health department.

The researcher, Dr. David F. Eastcott, thus had for comparison two virtually identical populations—the same constitutional or hereditary makeup, the same way of life, the same eating and smoking habits.

Lung cancer was 30% higher among the newcomers generally than among New Zealand's 2.3 million native-born whites, Dr. Eastcott reported. But among Britons who went to New Zealand relatively late in life—after living in smoggy England for 30 years or more—the prevalence of lung cancer was 75% greater than that for New Zealanders of the same age.

The conclusion is inescapable, Dr. Eastcott said, that lung cancer is a product of total environment—that polluted air plays a part, smoking another part, and infection and irritation are factors.

"Atmospheric pollution," he added, operates directly by pro-

viding carcinogenic (cancer-causing) substances which are taken up by lung tissue; and indirectly by greatly increasing the incidence of bronchitis, which then becomes a precursor of cancerous changes in the lungs.

"There is ample evidence to show that in a highly industrialized country, atmospheric pollution and associated lung damage may be responsible for at least half the lung cancer. But the factor of tobacco smoking has overshadowed this evidence, so that its significance has not been sufficiently, fully or widely recognized."

Put Precipitators In Power Station

A battery of electrostatic precipitators, built in the Baltimore shops of the Koppers Co.'s Metal Products Division, will guard against air pollution at the Baltimore Gas and Electric Co.'s new Charles P. Crane Station, now under construction on the shores of the Chesapeake Bay some nine miles east of Baltimore.

Contracted for in 1958, the four precipitators which will serve the first unit at the new power generating station were designed and fabricated in the Koppers shops during 1959 and are now being erected at the station site, which is on a neck of land between Saltpeter and Seneca Creeks in Baltimore County.

Each of the precipitators for the initial installation at Charles P. Crane Station will be approximately 25 ft wide, 18 ft deep and 27 ft high. Each has been designed to handle 152,000 cfm of dust-laden gas from a coal-fired cyclone boiler rated to produce 1,360,000 lbs. of steam per hour. With this method of firing, 80 to 85% of the total ash is removed in the form of slag, it was stated. The precipitators are designed to remove 95% of the remaining fly ash from the gas stream.

Each precipitator will consist of three separately-energized fields, or precipitation zones, and will be equipped with the most modern control devices and electrical components known to the industrial gas cleaning industry. As a space-saving feature, the precipitators were designed so that they be erected in two tiers of two units each.

Pennsylvania Law Starts Control Study

Under the terms of the Pennsylvania state law providing for air pollution control, passed recently by the legislature and signed by Gov. Lawrence, the first step will be a one-year study of conditions designed to lead to adoption of control standards.

Administration of the law will be in the hands of the Department of Occupational Health, of which Dr. Jan. Lieben is director, under policies to be set up by an 11-member Air Pollution Control Commission appointed by the governor.

The new law also provides for the appointment of regional air pollution control associations by the governor to rectify air pollution problems in their areas by "persuasion and conciliation." If the regional associations cannot stop pollution on a voluntary basis, the state commission will step in to enforce the new law through the state health department.

The commission will hold public hearings during the year's study period as part of its survey on which rules and regulations will be based. Within their limits, local units of government may continue to regulate air pollution. Under terms of the law, atmospheric pollution would be subject to a summary fine from $30 to $300 or 10 to 30 days in jail for the first and second offenses. Chronic violators could be fined from $500 to $1,000 and jailed up to one year in the discretion of the court.

In approving the law, the governor said he had recommended a stronger measure, but hailed the enacted bill as the first major step toward alleviation of what he called "one of Pennsylvania's major public health problems."

Plastic Hood & Ducts Vent Nickel Pickling Fumes

Ventilating hood-and-duct combinations, believed to be the largest of their type ever built from reinforced plastic, have been produced by the Duracor plant of The Ceilcote Co. in Cleveland for service in a large nickel processing plant.

When installed over nickel alloy pickling tanks, these vent hoods will handle corrosive fumes from nitric acid, hydrofluoric acid and dilute sulfuric acid at 180° F. Internal baffles and thick wall members make the entire unit rigid and self-supporting.

San Francisco Area Awaits Final Draft Of Regulation No. 2 Due In Mid-March

Control of emissions from industrial, incineration, materials handling, and heating and power generation is proposed by Regulation No. 2, now nearing final form for adoption by the Bay Area Air Pollution Control District.

The District's Advisory Council has approved the final report of the Committee on Exceptions and received a tentative outline of Regulation No. 2 from the committee on legal questions and clarification.

Final report of the committee on particulate emissions was to be presented at a special Council meeting Feb. 24. Test procedures and methods have been adopted.

The Council adopted committee recommendations on incinerators, following receipt of a summary report listing several tests.

Question of wording on compliance or non-compliance with the incinerator rule was referred to the legal questions and clarifications committee.

The District staff under Director Benjamin Linsky is preparing figures for evaluation in a table on particulate emissions which will be considered by the committee on particulate emissions.

Dennis R. Cronin, chairman of the committee on exceptions, said the District staff is working on the problem of ability of steamship operations and large boilers to comply with opacity and Ringlemann requirements.

Final draft of Regulation No. 2 is scheduled for presentation in mid-March to the District Board of Directors for their action, according to Advisory Council Chairman Dr. Bernard D. Tebbens.

(Please turn to following page)

NEWS of the Industry . . .

(Continued from preceding page)

Steel Plant Tests Bag House for Furnace

Testing of a "bag house" type of industrial air cleaner to treat smoke discharges from open hearth furnaces in a steel plant is underway at Judson Steel Corp.'s plant in Emeryville, Calif.

The test unit developed by Wheelabrator Corp. is treating five per cent of the discharge through one of the huge stacks at the Judson plant.

Test unit contains 36 filter bags which retain solids in the smoke discharge. Also incorporated in the unit is a spray cooler which reduces the 1,300° F. gases from the hearth to 275° F., this being necessary so that the filter bags won't burn up.

Installation of the pilot unit follows more than two years of engineering study and research of air pollution and systems suited for filtering open hearth gases, stated W. H. Manning, Judson Steel executive vice president.

"We are trying for a breakthrough in filtration cleaning of these gases," Manning said. "Bag houses have been used successfully on electric furnaces and we believe that the system, using improved bags and equipment, will work successfully on open hearth furnaces.

"Both Judson and Wheelabrator have worked hard for success in this joint operation which will mean improved efficiency along with a substantial saving in maintenance costs."

Cool Air Cuts Effect Of Radar Radiation

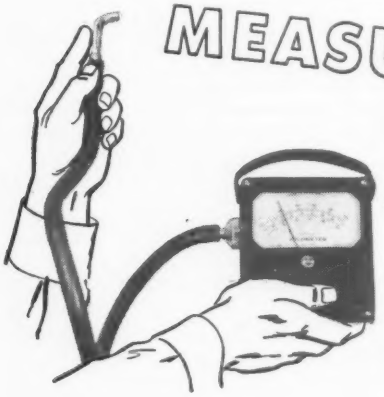
Injury from radar radiation varies according to air temperature and movement and is diminished if the exposure is only intermittent, reports Dr. W. B. Deichmann, professor of pharmacology at the University of Miami School of Medicine. "The effects of radar radiation depend largely on the ability to eliminate or to compensate for the micro-wave heat energy absorbed," he says.

An 18-month study, under grant from the U. S. Air Force, revealed that the survival time of rats exposed to radiation was tripled when the room temperature was reduced from 95° F. to 59° F. When the air of the room was circulated and blown on the animals, additional survival time was achieved.

G-E Hires Hygienist To Study Plant Health

An industrial hygienist, Lawrence F. Dieringer, has been hired to study and correct where possible environmental factors which affect the health of employes at the General Electric Co. plants in Pittsfield, Mass.

Dieringer will investigate such problems as dust, smoke, fumes, noise, temperature, radiant energy, humidity, illumination, ventilation, vibration, and dermatitis. A chemical laboratory has been set up for Dieringer's use in one of the Pittsfield Division's plant buildings.



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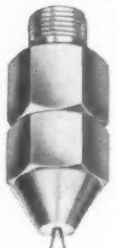

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Industry Looks At Air Pollution Control

Here's a reasoned approach to a calm, non-hysterical attitude toward air quality control, by an expert in the field.

by **William R. Bradley***
Assistant Director of Environmental Health Central Medical Department American Cyanamid Company

A GOOD DEAL HAS BEEN WRITTEN and said concerning the industrial contribution to air pollution, pointing out the fact that there is a concentration of industry associated with the large urban centers of population. It has been argued as to who was there first – the community or the industry, as if such arguments in any way could bring about a cleaner atmosphere.

Generally speaking, industry and particularly large industry, is keenly aware of the air pollution problem. Fortunately, there are only a few individuals in industry with recalcitrant minds on the subject of air pollution. They refuse either to recognize that they may contribute to air pollution or to spend money for its control until forced to do so by law. The overwhelming majority in industrial management does not hold such a view and while faced with tremendous economic problems in air pollution abatement, they, nevertheless, have made much more progress in abatement than has the general public.

A philosophy of cooperation between industry and the general public in seeking cleaner air will eventually dissolve the unfortunate concept that there is only one side to the air pollution problem. Air pollution is one problem shared alike by industry and by the private citizen. Both contribute to its existence. When this is realized, particularly in those areas where there is a recognizable nuisance of air pollution, then progress can be made. Air pollution abatement is not a subject for taking sides. Neither is it a subject for politics, for political maneuvering complicates and hinders progress in this field.

Air pollution can and is being lessened. Perhaps, all air pollution cannot be abated entirely in the light of our present knowledge and experience or in light of our present ability to pay the cost of control. It would appear that abatement of air pollution will

(Please turn to page 52)

**Mr. Bradley is a past president and director of the American Industrial Hygiene Association, Michigan Industrial Hygiene Society, a member of the Air Pollution Control Association, American Chemical Society, American Association for the Advancement of Science and the Health Physics Society. He is chairman of the Air Pollution Control Commission of the State of New Jersey. Mr. Bradley holds a B.A. degree from Cornell College, Mt. Vernon, Iowa, an M.S. in chemistry and biology from State University of Iowa.*

* * *

10 POINT PROGRAM FOR AIR QUALITY CONTROL

Enlightened industry does not shunt responsibility for air pollution control and will support proper legislation. The American Cyanamid Company in its role of a corporate citizen seeks to prevent air pollution in its local operation following a ten point program as its basic philosophy. This ten point industrial approach to the prevention of air pollution is as follows:

1. Determine if an air pollution problem exists. In this connection, work closely and confidently with official Air Pollution Control agencies.
2. If you have a problem, recognize it, for air pollution cannot easily be concealed.
3. Begin control studies through stack sampling and general air sampling.
4. Using the data obtained, begin research on methods for control.
5. Apply the results of research to engineering development of control facilities.
6. Begin pilot plant studies.
7. Install proven and tested control equipment.
8. Keep the plant neighbors informed of progress.
9. Invite the public to inspect the accomplishment and to celebrate success.
10. Inform companion industries of air pollution control techniques that may be useful to them.

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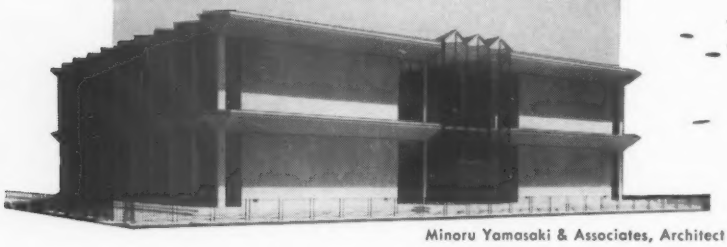


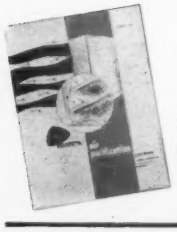
Minoru Yamasaki & Associates, Architect

Seen as a sign of the school's attitude toward advancing the cause for higher learning, Wayne's new AIA award-winning McGregor Community Conference Center has imposing significance. And just as significant is the careful attention given to the comfort needs of the Center's many occupants.

An installation of 44 high efficiency Dorex activated carbon air purification cells purges recirculated air of irritants and purifies it for sanitary re-use in the Center's large air conditioning system.

The reputation of Dorex for exceptional efficiency and adaptability is backed by more than 25 years of practical experience in the design and manufacture of air purification equipment. And a systematic replacement service—offered exclusively by Connor—guarantees the continuous, effective operation of every Dorex installation.

As shown here, the Dorex installation at Wayne is assembled in one central location. Activated carbon cells are arranged 11 wide by 4 high, and are protected by high efficiency dust filters. By this arrangement, which demonstrates the installation flexibility of Dorex units, space-conservation and exceptional purification efficiency are achieved.



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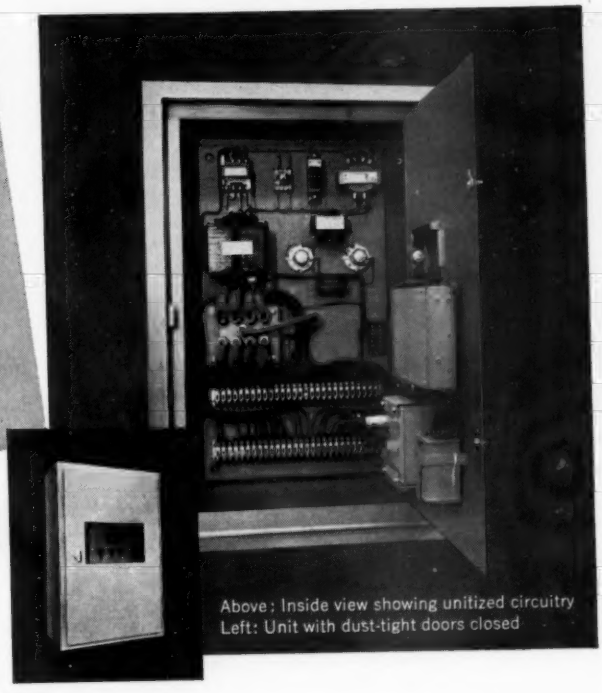
THE PROBLEM:

In the operation of Cottrell Precipitators it is necessary to remove the dust, fume or fly ash that has collected on the plates and cause it to be deposited in a hopper for subsequent removal from the Precipitator. The Rapping System should accomplish this removal with minimum disturbance to the already collected material (to avoid re-entrainment) and with maximum cleaning of the plates.

However, collected materials vary widely in their physical characteristics. Some are sticky. Some agglomerate readily and in thick layers without disrupting electrical operation. Still others have no tendency whatever to agglomerate, but form a sheet of loose particles on the plate.

There is no "typical" dust—no fixed set of conditions to be met. **Yet the Rapper System must be readily adaptable to efficient dust removal, regardless of dust characteristics!**



Above: Inside view showing unitized circuitry
Left: Unit with dust-tight doors closed

THE SOLUTION:

With so many variables to be compensated, unusually wide adjustability of the Rapper System has long been a prime objective for optimum operating efficiency. But complex factors have prevented its attainment until development of Western Precipitation's new "Full Range" Rapper Control.

By simply adjusting a few dials, "Full Range" Control permits:

- **FULL FREQUENCY ADJUSTMENT** from a complete rapping cycle every 50 seconds to one every 3½ hours... or any desired cycle in between!
- **FULL INTENSITY ADJUSTMENT** from zero to maximum over an unusually wide range!
- **FULL PATTERN ADJUSTMENT** 2, 4 or 8 impacts per cycle can be selected, with each cycle varying from light to heavy on successive impacts within the cycle—all automatically controlled to a choice of pre-selected operating limits!

Other Important Advantages...

Greater Safety: The "Full Range" Control has no dangerous high voltage circuits to endanger personnel. Entire unit is in "low-voltage" category.

All "Passive" Design: There are no motors, gears, or other high maintenance components in the "Full Range" Control. It is completely electronic.

Space-Saving Compactness: The "Full Range" Control requires about *half* the space of previous designs. Also is water and dust tight—can be located virtually anywhere.

Unitized Circuitry: All related parts are unitized into separate "cans" for simplified maintenance.

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Installation of Aerodyne Units at Consolidated Edison's Hell Gate Electric Generating Station.

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Green makes this AERODYNE mechanical dust collector, to collect fly ash and other dusts. Does this Green AERODYNE really work?

Well, let's quote a few words from Mr. J. J. Grob, Chief Performance Engineer, Mechanical Engineering Department, Consolidated Edison Company of New York, Inc.

★ **QUOTE 1**
Why used • • • • • • • **"At Hell Gate Station two Aerodyne mechanical collectors were installed in the uptake flues of boilers No. 11 and 12 for removing the bulk of fly ash leaving the furnaces."**

★ **QUOTE 2**
72 tons of fly ash per day • • • • • • **"The furnaces are slag tap and, of that ash which would otherwise be expelled to the electrostatic precipitators before entering the stack, the Aerodyne units, based on careful tests, remove approximately 72 tons of fly ash per day."**

★ **QUOTE 3**
Satisfactory • • • • • • **"The operation of the Aerodyne mechanical collectors has been satisfactory and the life of the cones has greatly exceeded expectations."**

We repeat, in all modesty—Green can help you solve FLY ASH and DUST collection problems.

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Letters

Wants "White Room" Data

Editor:

The article the "Meaning of Clean Air" reprinted from the April, May and June 1959 issues of AIR ENGINEERING, described various types of air locks, air showers, pass-through windows, ceiling diffusers, air pressure stations, adjustable louvers that supply air at high velocity, floor grating and low return air grilles for the air lock.

The above-mentioned items were installations of the Fafnir Bearing Co., Barden Corporation and Lear, Inc.

We are also trying to locate a type of air lock that has an air shower, with a blast of air from over-head diffusers, with return air pulled through a type of grille in the floor.

E. L. Levesque
Plant Planning and Layout
Miniature Precision
Bearings, Inc.
Precision Park, Keene, N. H.

Wants Data On Caps

Editor:

Please send me a copy of the August, 1959 issue of AIR ENGINEERING. I should like to review the comments of A. G. Mutimer on "Caps For Exhaust Stacks."

We would also be pleased to obtain more information about the Surchem Design of odor and smoke incinerators for wire enameling ovens; photos and letter (pertaining thereto) by Hector Audino (pg. 2, Nov., 1959 issue.)

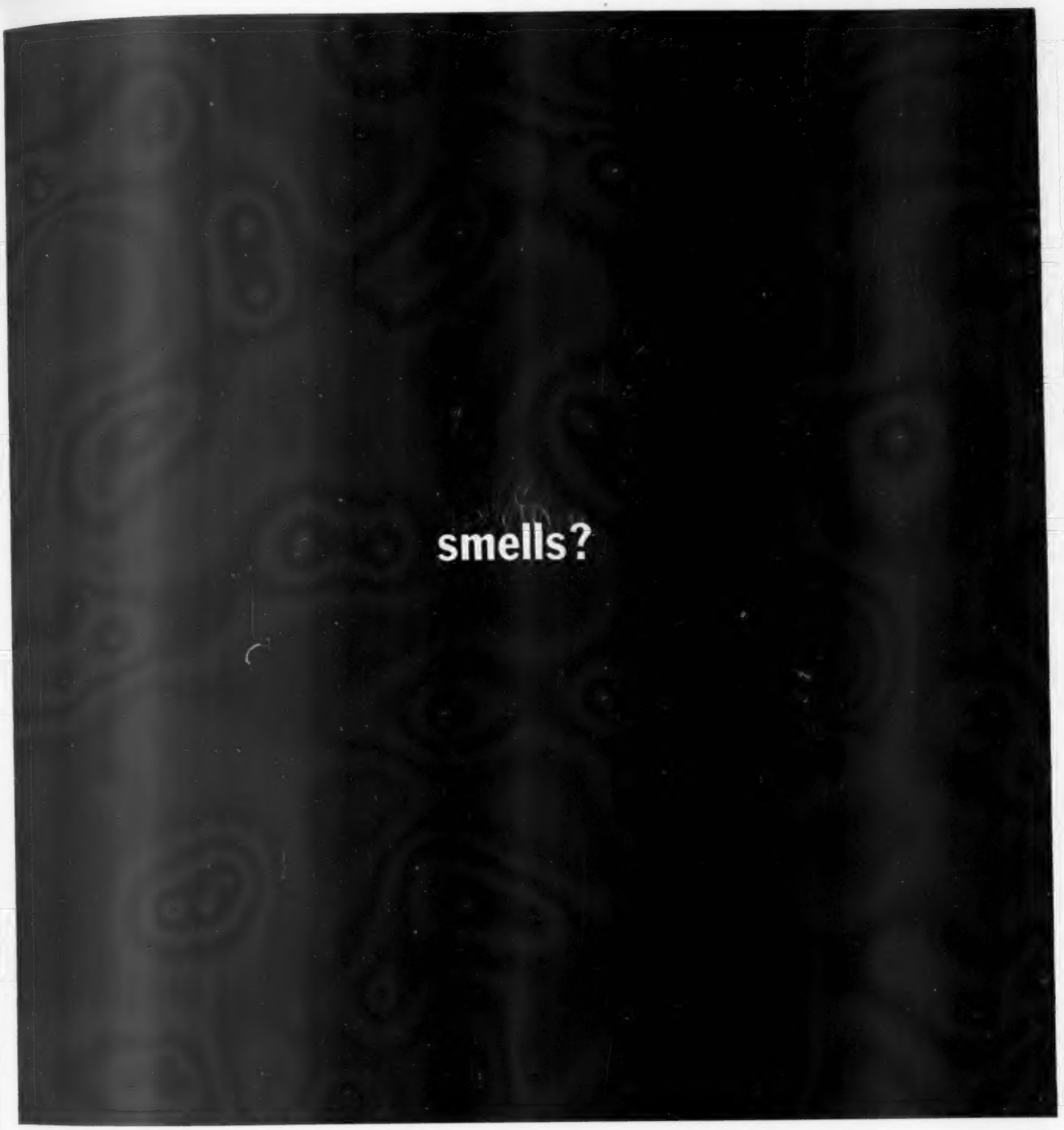
J. A. Smith.
Smith Combustion
Equipment Co.
Chicago, Illinois

Editor:

The article "Techniques for Designing Duct Systems" on page 29 of the November issue is of special interest to me, and I hope you will be able to spare a copy. Hardly a day goes by without the need for our people to recommend changes in users' duct layouts near our fan equipment.

W. E. Wendover
Senior Power Application Engr.
American-Standard
Industrial Div.
Detroit, Michigan

(Please turn to page 86)



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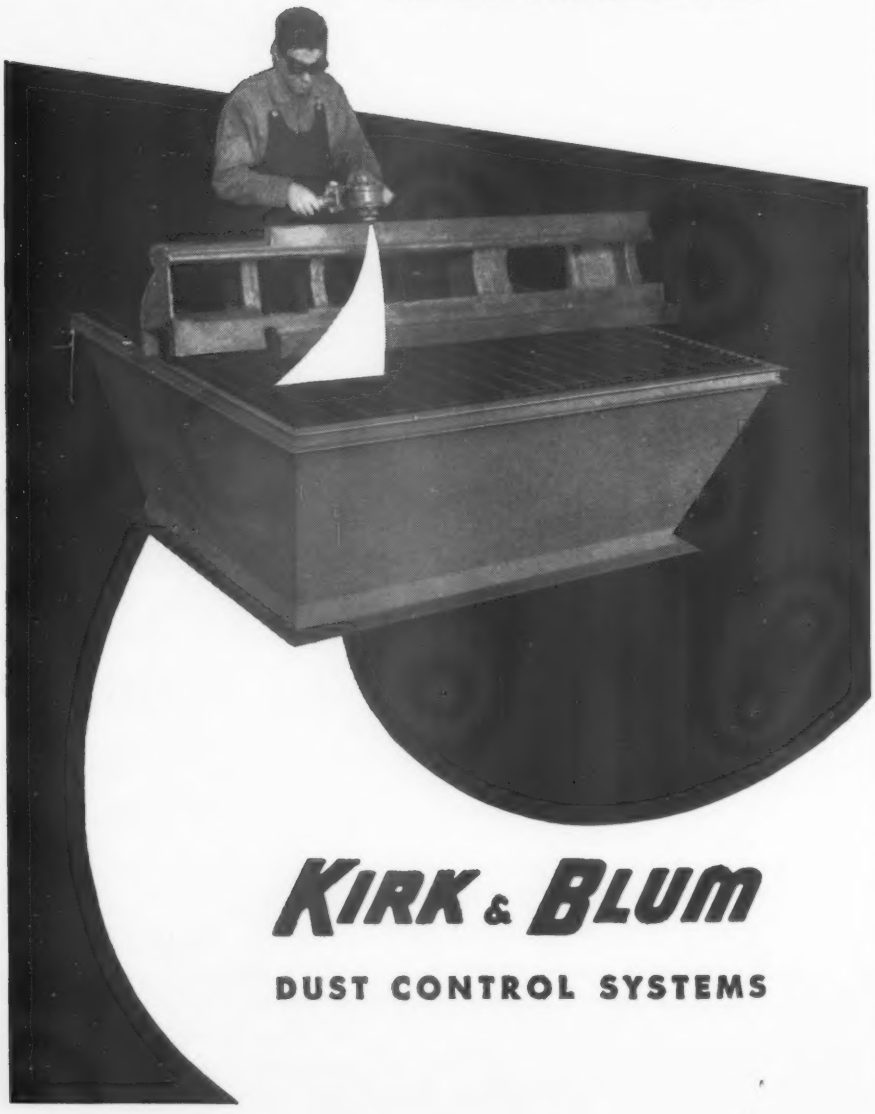

KIRK & BLUM
DUST CONTROL SYSTEMS

Letters

(Continued from page 24)

Agree With Editorial

Editor:

Dr. Frederick and I both thought your editorial in December was very interesting and thought provoking. We heartily concur with your opinion.

George M. Hama
Senior Associate Industrial Hygienist
Bureau of Industrial Hygiene, Detroit

A Much Needed Source

Editor:

It is my personal observation that this is a fine periodical, and one which will provide a much needed source for data and news concerning not only air pollution problems, but many other related fields, all of which come under our heading of "Engineered Atmospheres." I have been impressed, particularly, by the caliber of the writers of many letters to the editor which would indicate an unusually high level of reader interest.

Harry A. Brandt
J. O. Ross Engineering Div. Midland Ross Corp.
New York City

Wants "Gas vs Electric" Article

Editor:

I would appreciate your sending me six reprints of the article on "Gas vs Electricity As A Fuel" which appeared in the January, 1960 issue of your magazine.

Paul S. Park
E. Clifford Ebert & Paul S. Park
Registered Professional Engrs.
Pittsburgh, Pa.

* * *

Editor's Note:

Reprints of this article will be available soon.

Market Data Valuable

Editor:

I want to thank you for sending me a copy of your recent December issue of AIR ENGINEERING. We had a rather vague idea as to the extent of the air cleaning market. I should like to send copies (of your survey, p. 30) to all our representatives.

Daniel E. Grant
Manager, Technical Sales
Argo Plastic Products Co.
Cleveland

Engineer's Guide To Industrial Contaminants Now Available

The popular four-page article entitled "Engineer's Guide To Industrial Contaminants" is now available in reprint form.

The Guide lists sixty common airborne industrial vapors, fumes, mists and dusts, points out what part or parts of the body these substances affect, and gives the Maximum Allowable Concentrations of these substances.

This convenient Guide to Industrial Contaminants quickly enables the plant engineer, ventilation engineer or consulting engineer to check the hazard posed by any of the sixty substances listed, and to find the specific part of the body affected.

The chart was prepared by J. D. Fryfogle, M.D., of the W. D. Fryfogle Medical Research Laboratory, Detroit.

Prices for the reprints are: 1 to 9 copies, ¢15; 10 or more copies, ¢10 each; with prices for larger quantities available on request.

Use the addressed, postage paid cards in the Communications Center, page 37, for more information on new products, your comments about editorial material in this issue, suggestions for topics to be covered editorially, etc.

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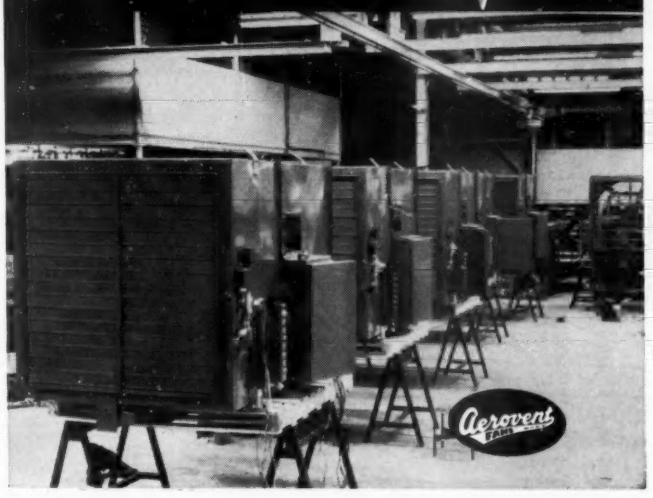

Pictured above is a portion of the final assembly line at Aerovent showing 8 units slated for delivery to a large Midwestern automobile accessory manufacturing plant. Designed to supply ample quantities of clean, pre-heated or cool, outside air to replace air exhausted by ventilating systems, the Aerovent Gas-Fired Air Make-Up Unit keeps air fresh; eliminates drafts and negative pressures. Safe, dependable operation and automatic, semi-automatic or manual control with natural, mixed, manufactured or propane gas.

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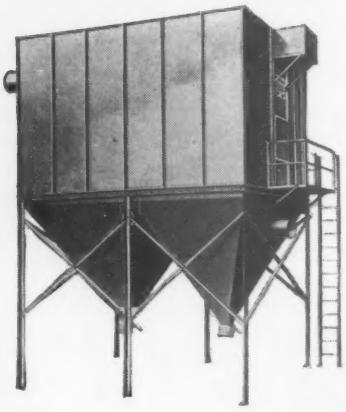

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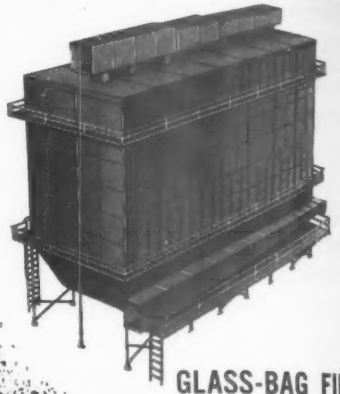

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dust control equipment

FULLER COMPANY GENERAL OFFICES

Plastics Plant Saves $25,000 Annually With $8,500 Ventilation System

by **Bernard D. Bloomfield**
Ventilation Engineer
Michigan Department of Health

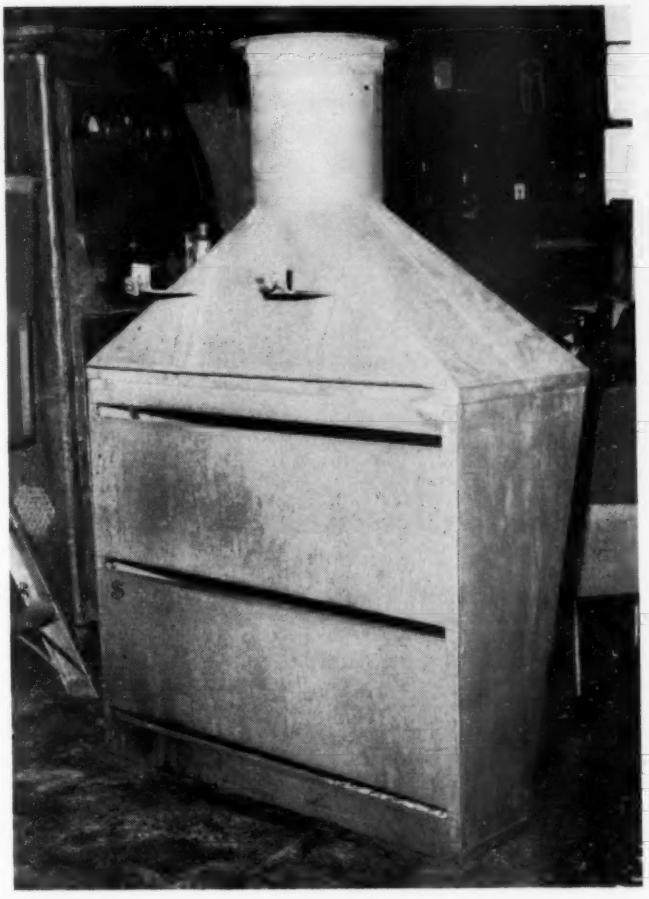

Fig. 1: *For compression molding machines, this slotted type draft hood does a good job of removing residual gases, without interfering with production operation.*

This plastic dishware plant was plagued with spotting that caused rejects. Here's the intriguing story of how a simple, low cost ventilation system eliminated rejects, helped boost production and aided employe comfort and morale.

PRODUCTION PLASTIC MOLDING operations sometimes present health problems by virtue of residual gases such as phenol or formaldehyde. These gases, given off during the compression-cure cycle, are frequently the cause of excessive workroom heat because of both radiation and convection and almost always necessitate the use of some type of air handling system so as to make working conditions more than tolerable.

This problem is made more complex when the parts to be molded require careful color control and when one speck of dust on the mold surface or on the plastic preform can result in a blemish part which becomes a reject.

The complete problem as associated with excessive formaldehyde exposure, high workroom temperatures and excessive rejects prompted management of a large molding plant to look for outside technical assistance. The problem was critical in the dish molding section of the plant, a departmental area measuring about 60 ft. x 30 ft., containing nine steam-heated compression molding machines, six preform dielectric heaters and an enclosed preform molding room.

A complete air supply and exhaust system was designed for the dish molding department and the subsequent installation served to bring about what one of the department foremen described as "the best change made in the department in years".

Cost of the supply and exhaust system for the dish molding room including materials and labor amounted to about $8,500.00 and in terms of reduction in rejects was paid for in about two months of operation.

This has been an unusually successful installation in terms of worker health, worker comfort and production economy.

Local Exhaust Ventilation System

Slotted type side draft hoods were designed and designated for all of the compression molding machines based on a design volume of 150 cfm/sq. ft. of maximum overall areas between the molding machine platens. The hood as shown in Fig. 1 is 3 ft.

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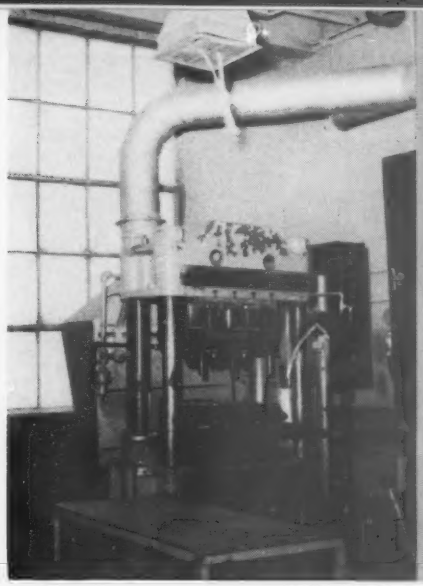


Fig. 2: *Left, the side-draft hood is shown as installed on a molding machine. For repair on the machine, the hood need simply be disconnected from the overhead duct at the flanged connection.*

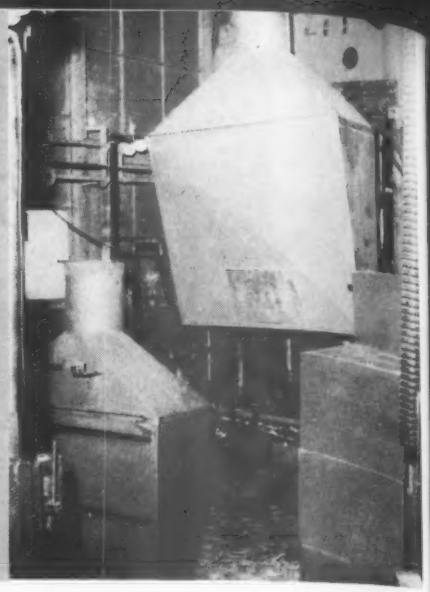


Fig. 3: *Right, back view of the side-draft hood illustrates a small access opening cut into rear of hood for removal of plastic fragments.*

x 3 ft. in size and is provided with three horizontal slots each 1 in. in width.

It is designed to handle an exhaust volume of 1230 cfm. The hood in no way interferes with the production operation and for most purposes does not have to be removed when machine repair work is to be done or dies are to be changed. Where a major repair job on the molding machine is scheduled it is simply a matter of disconnecting the hood from the overhead ductwork at the flanged connection.

Figs. 2 and 3 illustrate the side-draft hood as used. The back view of the hood in Fig. 3 illustrates a small access opening that was subsequently cut into the rear of the hood to enable removal of plastic fragments blown into the slots when the compressed air stream is applied to die surfaces for cleaning.

Hooding for Dielectric Heaters

Three different designs of dielectric heating units are used for the purpose of bringing the preforms up to use temperature. Since the heating units were essentially complete enclosures containing perforated grill-type air inlets as shown in Fig. 1, relatively low exhaust volumes were required for control of the formaldehyde vapors given off during the heating cycle. A design volume of 100 cfm/sq. ft. of net opening in the preform dielectric heating unit was used, this net opening being based on loading doors in the open position.

The dielectric heating unit illustrated in Fig. 4 requires installation of a canopy type hood inasmuch as it was not the enclosed type machine. Here again the design volume was 100 cfm/sq. ft. of hood face opening, this opening being 13 in. x 16 in. in size.

It may be possible that the dielectric heating period allows for some contamination of the preform. If so, the approach toward the control of particulate contaminants would be installation of renewable type air filters located in front of all air inlet openings. These can be built into each of the four larger dielectric heating units as shown in Fig. 5.

Preform Room Exhaust

Ventilation control is particularly critical in the preform room since any contamination of the preform results in a rejected dish. A total exhaust volume of 1,000 cfm was designated for this room with the use of a side-draft hood located along the rear wall as shown in Fig. 4. It was intended that an air supply in excess of the amount exhausted would be supplied to this room as a means of minimizing contamination from the adjacent areas.

Duct System Design

A balanced duct system design was used, with the exception of one location in the preform room. The complete duct layout is illustrated in detail in Fig. 4. The author has had considerable experience in the design of local exhaust ventilation systems and has never encountered any industrial process where the blast gate system of design was either necessary or advantageous.

(Please turn to page 32)

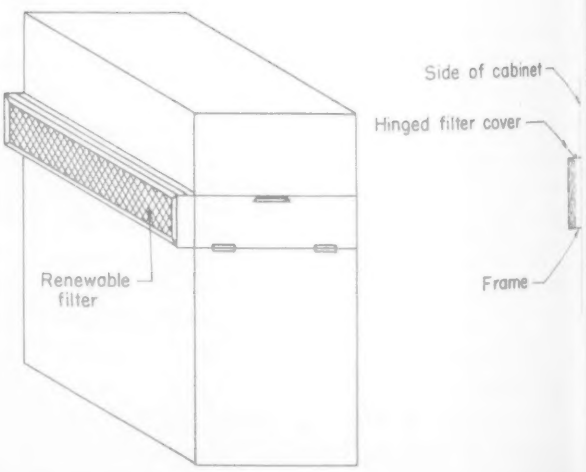


Fig. 5: *To eliminate contamination of the pre-form from particulates, renewable type air filters as shown above can be located in front of all air inlet openings.*

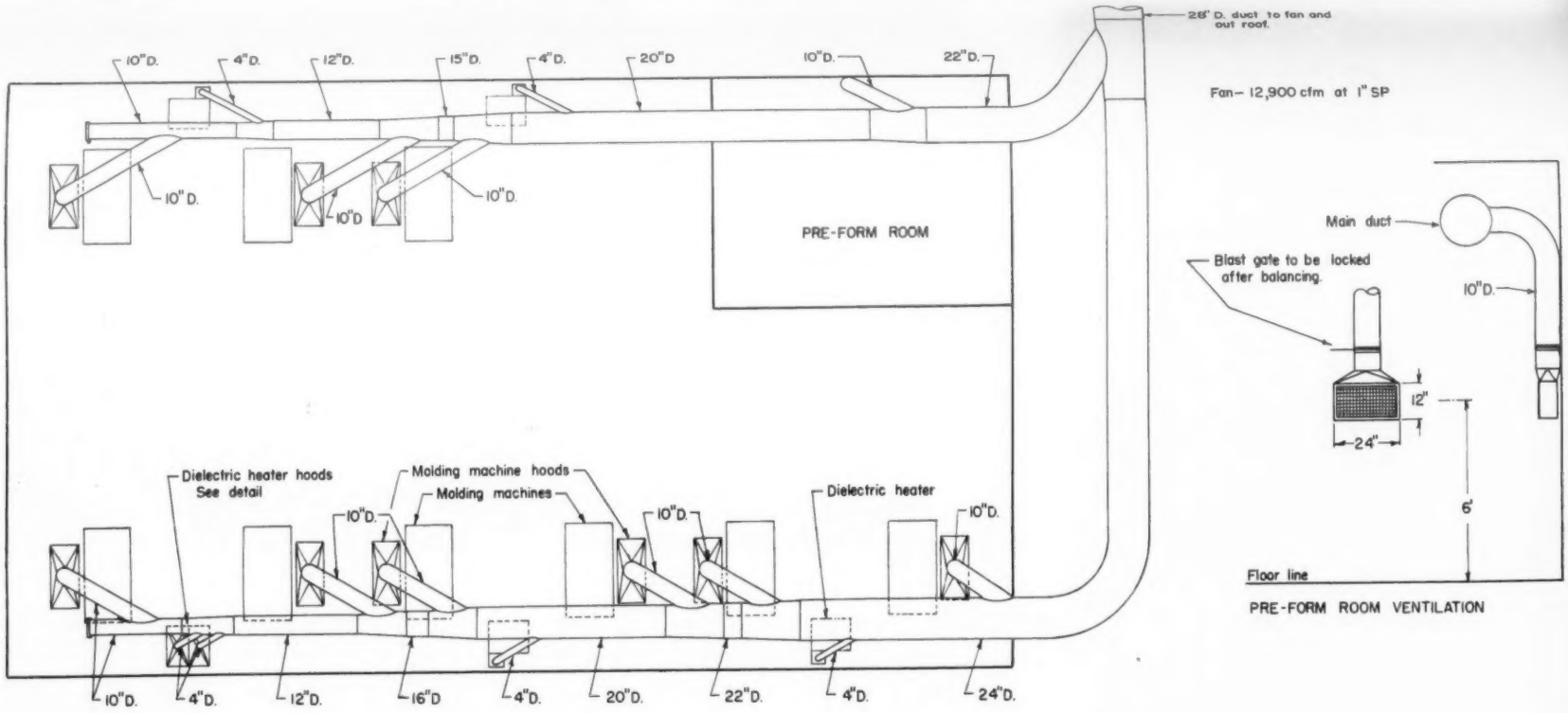
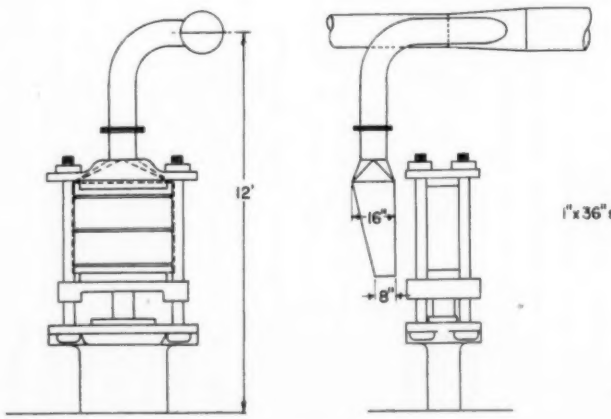
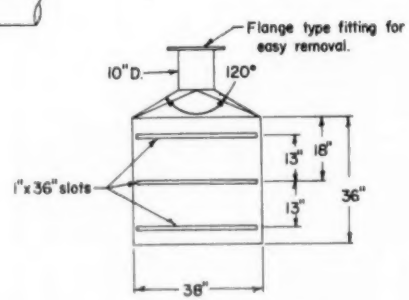


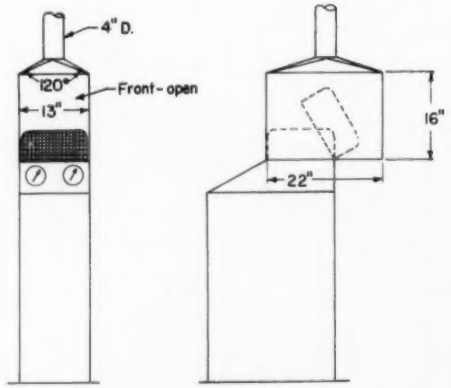
Fig. 4: *This general view of molding room ventilation system and hood installations, at bottom, illustrates how a canopy type hood was installed on pre-form dielectric heating units. Note also the installation of a side-draft hood along the rear wall, for general pre-form room ventilation, to prevent contamination from adjacent areas.*



MOLDING MACHINE HOOD INSTALLATION



MOLDING MACHINE HOOD DETAIL



DIELECTRIC HEATER HOOD

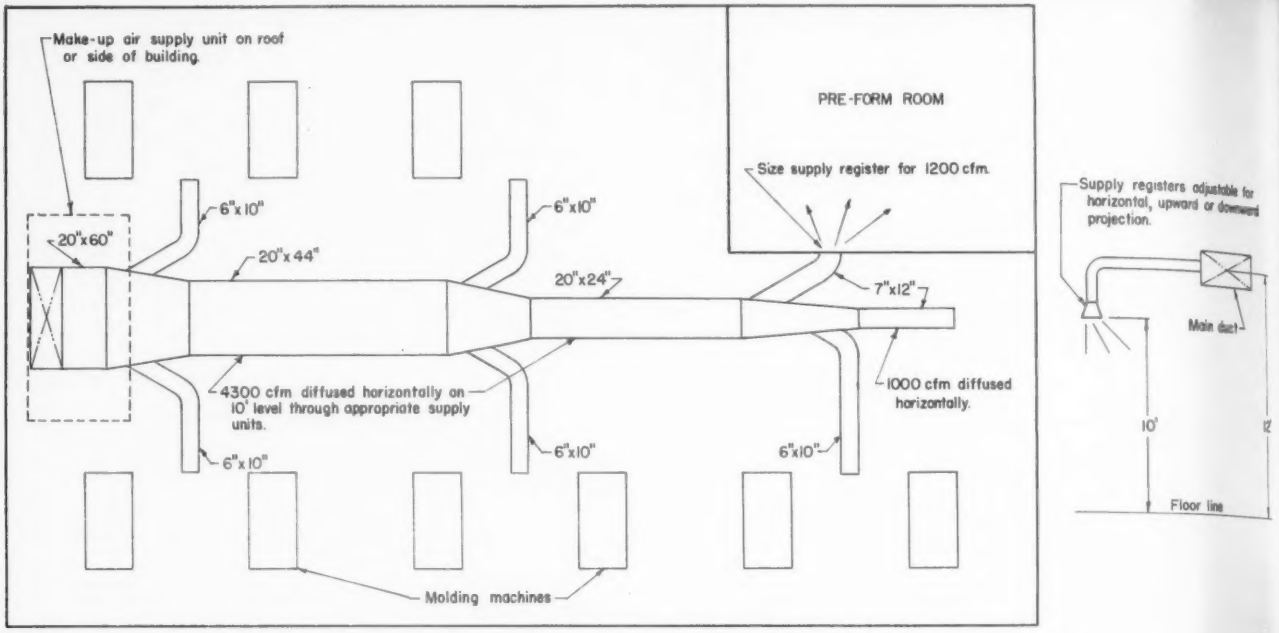


Fig. 6: ***This drawing shows air supply system layout in the pre-form room. Note that a portion of supply air is introduced through registers mounted flush in sides of supply main.***

(Continued from preceding page)

On the other hand there are occasional instances where the use of a blastgate (such as in the preform room in Fig. 1) which can be locked in place, is useful for the balancing of an isolated branch which imposes a significantly different resistance than the branches and connecting hoods in the remainder of the system.

Inasmuch as no particulate matter was to be conveyed in the duct system an optimum design transport velocity of 2,000 fpm was used. The construction specifications called for well-designed fittings including 30° branch entries, and elbows having centerline radii of 2 duct diameters. Based on the exhaust system design a fan capable of exhausting 12,900 cfm at a static pressure of 1 in. w.g. was specified.

Supply Air System

A supply of tempered make-up air was required in the dish molding department not only to balance the exhaust volume and thereby minimize contamination from the outside or the adjacent plant areas, but also to serve the additional purpose of spot cooling for the molding machine operators. Fig. 2 illustrates a supply air register located over a work station and Fig. 7 shows a large portion of the supply duct system.

Experience has indicated that spot cooling is most effective when the register is located as close as possible to the worker, when a means of adjusting direction of air flow is available to the operator and further when the velocity of the air in the working zone is sufficiently high (300-800 fpm) to produce the desired cooling effect.

Because of the critical nature of the work being done a filter system was designated for the supply air. An automatic roll type unit (Fig. 8) using fiberglass filter media and rated at 13,000 cfm was selected for use in this installation. It was recommended that supply registers be specified on the basis of 1300 cfm each with a terminal velocity of 300 fpm at a distance of 13 ft. from the register.

Also it was specified that registers should be adjustable for horizontal downward and upward projection. As illustrated in the air supply system drawing, Fig. 6, a portion of the supply air is introduced through registers which are flush mounted in the sides of the supply main. It was further recommended that consideration be given to evaporative cooling equipment for the air supply portion of the system.

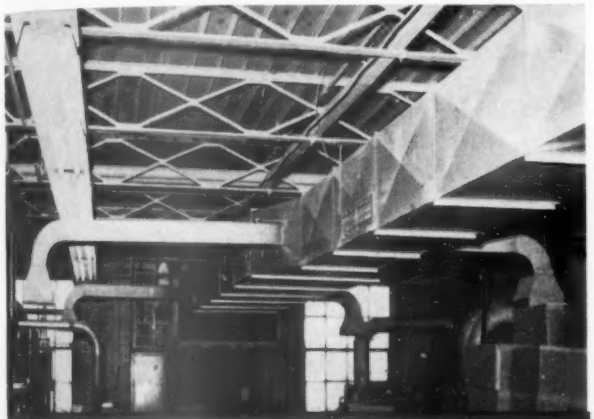
During warm weather months, outdoor air conditions coupled with the steam heated molding machine platens and the somewhat crowded condition in the dish molding area, created an excessive temperature build-up. Because of the need to maintain air flow balance and to minimize entry of air contaminants into the dish molding area from the outside as well as from the adjacent plant space where black parts are molded, doors and windows were to be kept closed.

The new ventilation system was also to obviate the need for two large axial flow fans mounted in the ceiling, and these openings too were to be closed off. However, operation during the summer following

installation of the system soon demonstrated that despite outside make-up air supply and exhaust ventilation, the cooling load as created by the character of the operations and the building design was far too great to be satisfied with the balanced supply and exhaust system alone. Temperatures of 110F were reached in still areas of the workroom during the hottest days of the summer and when these high temperatures were approached, windows were opened. The cooling load created by the hot molding machine surfaces and normal room activity, caused discomfort among some of the employes despite the provision of high velocity outside air in specified working zones. There was also a gradual increase in the temperature of the air in the ceiling area of the room.

It was recommended that warm air in the ceiling area be discarded to the outside through gravity type ceiling vents. Since the door connecting the two departments of the plant is always closed and more air is being supplied than is exhausted from this department, a positive air balance could still be maintained despite the installation of roof vents.

Management was also told that effectiveness of the spot cooling system could be further improved with installation of evaporative cooling equipment in the supply air ventilator housing. Initially the supply air unit was specified and selected with design features that enabled installation of evaporative cooling sprays at a later date.



System Measurements

In the Fall of the year following completion of the installation, a ventilation study of the exhaust and supply portions of the system in the dish department was conducted for the purpose of evaluating the volumes of air handled at the individual supply and take-off points, thereby enabling comparison of the original system design. Also, since the heat problem developed during the warm weather months, this data was needed to facilitate comfort ventilation design procedures.

The original exhaust system design called for a minimum exhaust volume per molding machine of 1230 cfm and a minimum volume of 180 cfm from each preform induction heater. The total design volume for this system as designated previously was 12,900 cfm with a static pressure resistance of 1 in. w.g. Volumes exhausted per molding machine were found to range from 800 to 1300 cfm and for the preform heating unit from 139 to 235 cfm, with a total exhaust volume of 12,650 cfm. Fan static pressure based on fan inlet measurement was found to be 1.1 in. w.g.

Deviation from original design exhaust volumes might be explained by the fact that some holes had been cut into the main duct for the purpose of exhausting some of the high temperature air from the ceiling area and were not completely blocked off at the time of our evaluation study; one hood was disconnected from the main system, also producing an unbalancing effect, and one or two unorthodox additions had been made to the system. However, at the time of the study it appeared that satisfactory control was being maintained at all operating areas in the workroom.

The original supply air system design called for a volume of make-up air equal to that exhausted, the static pressure resistance of the system to be calculated on the basis of registers, ductwork, filters, coils and housing. Supply air registers of the type which enabled flow direction adjustment by the workers were specified at a design volume of 1300 cfm each. Our study readings indicated a range of from 1020 to 1240 cfm being supplied through each of the

(Please turn to page 57)

Better Air for Industry

PART IV

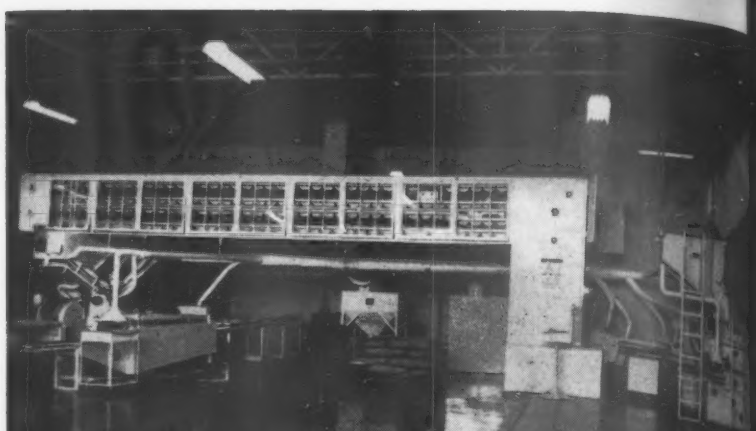


Fig. 1: *Dry dynamic type collector with air inlet duct box keeps bakery dust free. All dust producing points are hooded with the dust collecting on the surface of cloth envelopes in the box.*

by Richard V. Sloan, *Senior Engineer*
American Air Filter Co.
Los Angeles, Calif.

Part IV of this series on the merits and shortcomings of air cleaning equipment investigates high efficiency centrifugals, dry type dynamics, unit collectors, and their costs.

RESEARCH INVESTIGATIONS of the cyclone principal have produced a number of design modifications. By increasing centrifugal forces available and by reducing design faults causing dust re-entrainment, good collection efficiencies have been maintained on particles in the 10 to 20 micron groups.

Collector designs usually employ a number of smaller diameter units with identical elements arranged in parallel to clean the gas volume involved. Heavy construction to withstand abrasion is typical for this group. Pressure drop will be in the 3 to 8 in. range.

Like the low pressure drop cyclone, these centrifugal collectors are sensitive to variation in exhaust volume except those designs incorporating a second, secondary dust circuit. The small models with their small dust outlets may cause trouble from plugging if coarse or foreign materials are picked up, or material is collected that is damp or has a packing tendency.

In any collector of the cyclone type, dust removal from collector must be continuous and if operated under suction, discharge gate or dust storage bin and its connection must be air tight. Air leakage in at dust discharge point, or storage of collected material within the collector, will dramatically reduce its efficiency.

Dry Type Dynamic Precipitator. In this collector dust is precipitated by centrifugal and dynamic forces on numerous specially shaped fan blades. Collected dust is forced along blade surfaces and is discharged into a separate dust circuit within the fan housing. From here, it is conveyed pneumatically to a dust storage hopper.

Collection efficiency is in the range of the high efficiency centrifugals, and space requirements are extremely small. Design does not lend itself to large exhaust volumes or to handling of fibrous, sticky materials or to applications involving collection of large pieces of product or foreign material.

No external pressure loss is involved, although mechanical efficiency of the precipitator will be lower than that of the conventional industrial exhauster which it replaces.

Unit Collectors

To fill the need for dust collection from isolated, portable, or frequently relocated dust producing operations, a number of unit collector designs are available having capacities in the range of 200 to 1,000 cfm. Featuring small space and designed to recirculate the air, collectors of this type have been used extensively, especially in the aircraft and metal working industry.

Most of the criticism leveled at this group of collectors has been prompted by their misapplication where purchasers have failed to appreciate their limitations. Intended for lighter dust loads and/or intermittent operations, dust holding and storage capacity, servicing facilities, and longer periods between maintenance, have all been sacrificed, in many cases, for small space and low first cost.

While performance can be completely satisfactory for lighter loads such as tool room grinders, occasionally used cut-off saws, or light loadings for package filling, applications should be carefully examined

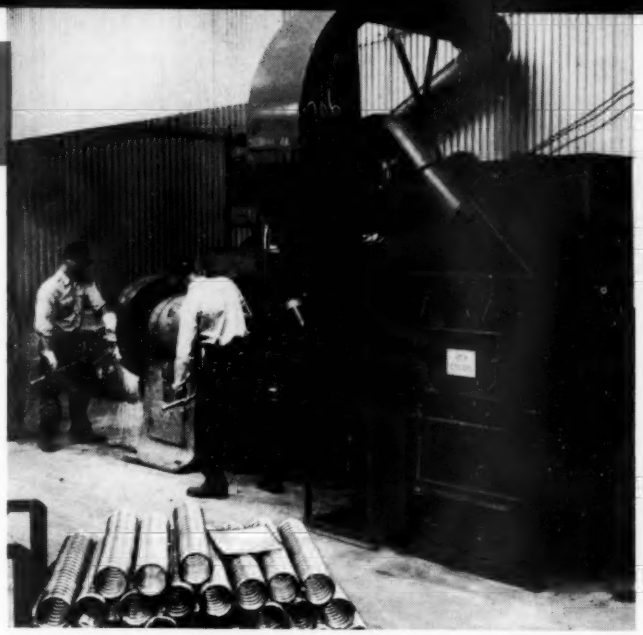


Fig. 2: Spring grinding exhaust uses oil to filter out dust particles. It returns cleaned air to the work room.

before installation is recommended for continuous dust producing operations which release moderate or heavy quantities of fine dust.

Their use also becomes questionable where a larger number of unit collectors are installed within an area in which a central exhaust system would be practical. Dust removal and servicing requirements from a number of such unit collectors are expensive, and are more apt to be slighted than would be the case with a single large collector with its one dust disposal point, its greater dust storage capacity, and a construction that could reduce frequency of service and maintenance attention required.

Costs

The variation in equipment cost, especially on an installed basis is difficult to estimate. Any figures used for comparisons are complicated unless a thorough knowledge of the factors included or the items not included are carefully evaluated. Factors which make useful cost estimates difficult include:

Price Versus Capacity. All dust collector prices per cfm of gas handled will vary with the volume involved. The smaller the volume, the higher the cost per cfm. The break point, where price per cfm cleaned tends to level off, will vary with the design.

Accessories Included. Careful analysis of components of equipment included is very important. Some collector designs include exhaust fan, motor, drive, and starter. In other designs, these items and their supporting structure must be secured from other sources by the purchaser.

Likewise, while dust storage hoppers are integral parts of some dust collector designs, they are not provided in other types. Duct connections between elements may be included or omitted. Recirculating water pumps and/or settling tanks may be required and may not be included in the equipment price.

Installation Cost. Installation cost can equal or exceed the cost of the collector, depending on the method of shipment (completely assembled, subassemblies, or completely knocked down), on location which may require expensive rigging to put in place, and on expensive supporting steel and access platforms.

The cost picture can be measurably influenced by the need for water and drain supply, special or extensive electrical work, and expensive material handling equipment for collection material disposal. Items in the latter group will often also be a variable decreasing in cost per cfm as the volume of gas to be cleaned increases.

Special Construction. Prices shown in any tabulation must necessarily assume standard or basic construction. Increase in cost for corrosion resisting materials, special high temperature fabrics, insulation and/or weather protection for outdoor installations, can introduce a multiplier one to four times standard construction cost.

Dust Disposal or Salvage

Many a headache would be prevented if handling of collected material were considered at the time collector design and location are examined. Quantity of material will influence equipment and methods.

An estimate of the amount of material to be collected will permit estimates on required storage capacity of hoppers and transfer equipment as well as frequency of servicing. Such considerations will assure collector locations where access will be convenient and disposal practical.

With dry collectors, collected material can be discharged through dust gates, trickle valves, rotary

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Fig. 3: Stand grinder exhaust of the dry centrifugal type returns cleaned air to the work room.

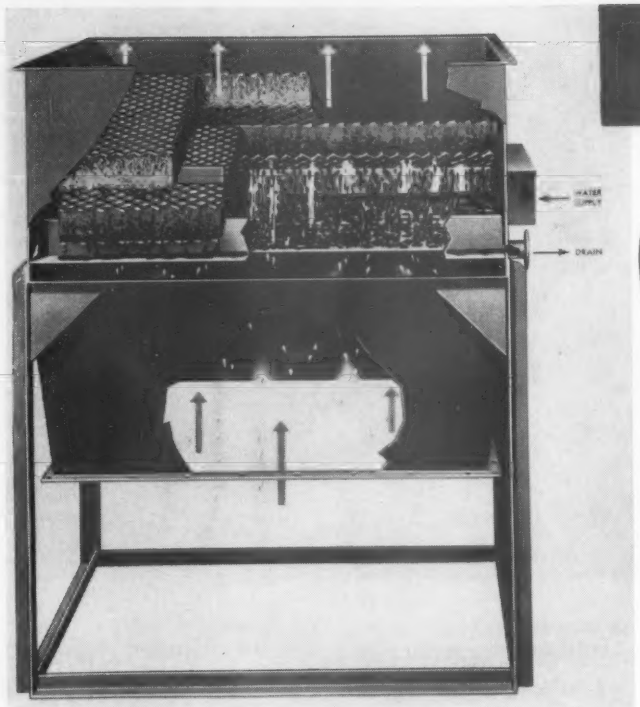

Fig. 4: Cutaway shows operation of an acid mist vapor collector for plating and grinding operations

(Continued from preceding page)

locks or screw conveyors to tote boxes, truck bodies, or continuous material handling equipment.

Every effort should be made to prevent dust dispersion during the handling operations. Dusting will be a particular problem as particle sizes become smaller and the concentrations heavier. Wetting of dry dust as it leaves collector or storage bin is difficult to do effectively.

With wet collection, disposal methods will be selected from sluicing of collected material to process, waste tract, or remote settling tank. Dewatered material may be handled in batches or by continuous material handling methods.

The major disposal problem will be the selection of transport equipment that will eliminate spillage with the housekeeping problems that could be introduced. Water supply and waste water disposal should be investigated also before final decision on collector arrangement and location.

Equipment Location, Servicing and Maintenance

Because dust collection equipment is not truly production machinery, it has too often been installed in a place that is inaccessible with the unfounded hopes that once installed it can be forgotten.

Nothing is further from the truth. The more effective the design, the more complicated will be collector construction and the more frequent need for inspection and preventative maintenance.

Provision of access ladders and servicing platforms for overhead installations is very important. Weather protection should be provided for units installed on roof tops or in other outdoor locations.

Manufacturer's installation, operation, and maintenance instructions should be carefully read. A schedule should be established setting down the frequency of operations to be performed.

Provision for part replacement before actual breakdown occurs will pay dividends in preventing costly shutdowns that often stop an entire plant's operation.

The manufacturer can recommend ways of spot checking performance. Often it is possible to install U gages or ammeters that will quickly indicate reduced exhaust volume. Most designs also have telltale sections that will indicate less contaminant collection efficiency.

Next month's instalment will contain a check list of things that should not be done when selecting and applying dust collecting devices. ▲▲

Ventilation Studies In the Plastics Industry

Respiratory exposure to styrene vapors, as well as skin contact with liquids and dusts, represent significant hazards in the manufacture of glass fiber polyester resin boats by the hand lay-up process, reported Peter A. Breysse of the University of Washington's Environmental Research Laboratory at a meeting of the Pacific Northwest Section, American Industrial Hygiene Association.

Since styrene is utilized as the monomer in the polyester resin system for boat manufacturing, workers engaged in the plastic application and curing steps are exposed to its potentially harmful vapors, and if a threshold limit of 100 ppm is exceeded, there is a good chance that workers may become ill.

In a survey conducted by the Environmental Research Laboratory in a plant without adequate ventilating facilities, a series of breathing zone atmospheric samples around a hull lay-up operation showed airborne styrene concentrations ranging from a high of over 250 ppm. to a low of 78 ppm., with a majority of the samples being well over the threshold limit.

In a larger plant, where two exhaust fans had been installed in each lay-up room, only one of 10 samples collected was over the styrene threshold limit.

What You Should Know About RESPIRATORS

PART II

If plant ventilation system fails and workers face lethal concentrations of toxic gases . . . if dusts are hard to control, you may need respirators. Here's the second of a series on industrial dusts, gases and vapors . . . and the respirators to protect against them.

by **H. H. Fawcett***
Research Laboratory
General Electric Co.

Fig. 1: ***Respirator-goggle combination for general and agricultural exposures and radioactive particulate. It is made in either ventilated or gas-tight types.***

IN PART I, WHICH APPEARED in the January issue (Part II was crowded out of the February issue), the author started classifying air contaminants according to their physiological effects – toxic, pneumoconiosis-producing, and nuisance. He continues with gases, vapors, and their effects.

Gases and Vapors

In this major group may be included most of the air contaminants which are not classified as aerosols.

Irritant gases are those which produce inflammation of tissue, such as the skin, the eyes, and the respiratory tract mebranes. They are divided into two general groups:

a. action is limited to irration (such as caused by hydrogen chloride)

b. action extends to systemic effect (such as oxides of nitrogen)

Some of these gases and vapors have pronounced odors, but the nose cannot be depended upon as a reliable method of estimating concentrations.

Asphyxiants are substances which deprive the body tissues of oxygen, causing hypoxia (oxygen starvation). Two general methods of action are known: *simple* asphyxiants (such as nitrogen, hydrogen, helium, and methane), which dilute or replace the oxygen partial pressure in air; and *chemical* asphyxiants (such as carbon monoxide, hydrogen cyanide, hydrogen sulfide, acetonitrile, aromatic nitro and amino compounds like aniline, nitrobenzene and derivatives), which combine with the hemoglobin of the blood to prevent oxygen-carbon dioxide exchange.

The insidious nature of the action of the *simple* asphyxiants, and the speed with which they can act, is still not widely appreciated; whereas most people have a healthy respect for the *chemical* asphyxiants. Under proper medical supervision, pure nitrogen may be breathed for several seconds and this technique has been used clinically by H. E. Himwich and others.[1]

However, nitrogen and the other *simple* asphyxiants give almost no warning between the time breathing air is replaced with the asphyxiant and uncon-

*Mr. Fawcett is a Safety Engineer of broad experience with General Electric's Schenectady Laboratory.

1 A Symposium on Anatomy, Physiology, Measurement Control, and Psychology of Odors held at the Chemical-Toxicological Conference, Industrial Hygiene Foundation 22nd annual meeting, Oct. 30, 1957 at Mellon Institute, Pittsburgh. These papers are available in the transactions of the Foundation, 4400 Fifth Ave., Pittsburgh 13, Pa.

Himwich is now research director of the Galesburg State Hospital, Galesburg, Ill.

sciousness overtakes the subject. A loss of mental facilities begins within a few seconds, and unconsciousness may occur shortly after with no warning. The brain is the first organ of the body to be seriously affected by oxygen want, and the subject "blacks out" quickly.

Mention is made of this little-appreciated phenomenon not only because asphyxiants can be released in a room or tank with inadequate warning from the action of a fixed carbon dioxide fire extinguishing system, from a large spill of liquid nitrogen, from a leaking gas system, from an inert-gas producer, or from a leaking cylinder, but also because airline-supplied respirators, hoods and suits are frequently attached to a plant air supply with little appreciation of the hazard.

Oxygen, used indiscriminately, may also be a hazard, since serious fires have been reported where oxygen, either from a cylinder or from what was thought to be an airline, or from a leaking hose or pipe, was used for breathing purposes in an airline respirator or hood where welding or other flames were involved. Only a completely separate air supply, supplied by a compressor which cannot evolve carbon monoxide, carbon dioxide, oil mist or other unwanted impurities or from cylinders of tested known purity should be used for airline respirators, hoods or suits. In any event, regardless of supply, the system should include pressure relief valves, filters and absorbents.

Anaesthetics

Anaesthetics are gases and vapors whose action is primarily by inducing the symptoms of anaesthesia when inhaled in sufficient quantities. These include the substances which come to mind when the word "anaesthetics" is mentioned, such as the ethers, chloroform, methyl chloroform (1,1,1-trichloroethane), trichloroethylene, ethylene oxide and nitrous oxide (laughing gas), as well as hydrocarbons, aldehydes, ketones, other halogenated hydrocarbons, the aromatic hydrocarbons, alcohols, esters, and carbon disulfide.

In addition to the physiological action of these materials alone and in combination, decomposition products are produced in a fire or when they are otherwise subjected to heat. Even relatively harmless substances such as the "Freons" and the "Genetrons" will evolve toxic decomposition products if they are heated above their decomposition temperatures. This has occurred where "Freons" and "Genetrons" were used as cleaning solvents. Metal parts, after cleaning, were heated above the safe limits in order to dry and flash off the remaining solvent. Several persons were hospitalized with pulmonary congestion.

Trichloroethylene degreasers, properly installed, maintained and operated, are safe, yet the failure or misuse of these vapor degreasers has created serious hazards including both fires and toxicity. Mass hysteria and unconsciousness due to the little-

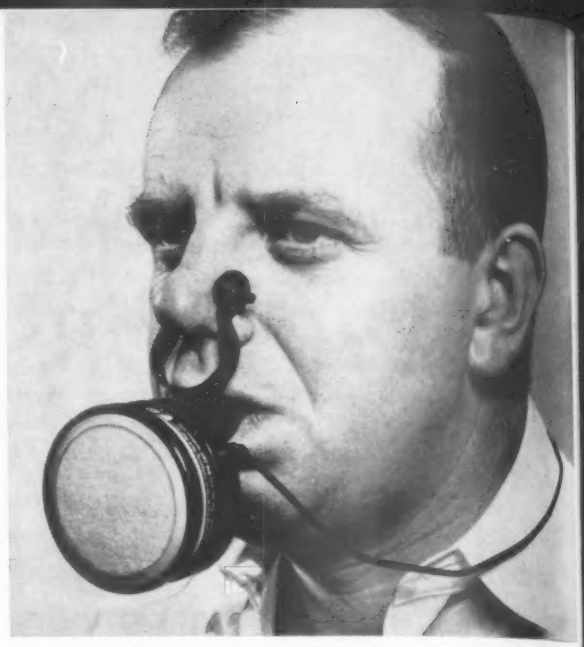

Fig. 2: *Pocket respirator for protection against dust, organic vapors, and low concentrations of acid gases. It is designed for continual or emergency use against single or multiple hazards.*

appreciated anaesthetic action of the trichloroethylene has occurred in seconds; in one incident 72 persons were overcome, and in another, 26. Fortunately, all recovered after removal to fresh air and oxygen inhalation. The hazards of carbon tetrachloride mixtures in fire fighting and in other applications is well documented.

Substances Producing Other Effects

This classification includes several substances whose action differ from previously-mentioned sub-

(Please turn to page 57)

Fig. 3: *Single cartridge type respirator has interchangeable cartridges. With one face piece, user can protect against nine specific dusts, organic vapors, acid gases, ammonia, and other alkali gases.*

Solves space shortage, provides for future load characteristic changes with . . .

Unique Radiant Heating and Cooling System

by **Adolf Nuchtern**
Partner, Joseph R. Loring & Associates
Consulting Engineers

In this 120,000 sq. ft. addition to a factory office building, the consulting engineer faced problems of restricted room height, water table that prevented use of trenches and need for future individual control of zones or modules.

CONSTRUCTION is now under way on a three-story addition to the office building and research center for Melpar, Inc., Westinghouse Air Brake Research and Development Laboratory, 3000 Arlington Boulevard, Falls Church, Virginia. The air conditioning and heating system for this addition has been designed as a combined radiant heating-and-cooling ceiling panel system, a chemically regulated humidity control system and full ventilation for the 120,000 sq. ft. building.

The basic architectural design concept was predicated upon achieving the construction of three floors in the same overall building height required for the existing two-story building, with physical connections between the two buildings to be accomplished by means of interconnecting ramps. The new addition will house Melpar's office, accounting and business machines, personnel and other administrative departments, as well as the drafting and technical writing staffs.

Humidity control was required because of accounting machine punch cards, technical illustrations and similar functions and equipment. Year-round air conditioning is required for the comfort of Melpar's personnel.

The air conditioning, heating, humidity control and ventilation system, as well as the complete electrical and plumbing systems, provides for the above requirements in every respect as well as providing a completely flexible and controlled environment capable of accommodating future changes in load concentrations and space and partition arrangement with minimum modifications to the system or ductwork.

Special Conditions

The air conditioning design was fundamentally influenced at the outset by a combination of space limitations caused by the following factors:

1) In order to limit the "cube" and thus reduce the overall cost of the structure, the architect decided to construct a three-story addition directly adjacent and connected to the existing two-story building. The floor-to-floor heights in the existing building of 16 ft. 8 in. and 13 ft. 0 in. were established to accommodate space requirements of the all-air low pressure air conditioning system presently installed.

The problem facing the engineers therefore was to design a system which would fit into these sharply reduced floor-to-floor heights and provide capacity for the increased lighting and population loads without sacrifice of performance.

2) The extensive antenna research program conducted by Melpar, for which the roof area must be used, forced the architect to maintain the new roof line at the exact height of the existing roof, thus imposing an upper limit to the space conditions. A further consequence of Melpar's antenna work necessitated elimination of all fan rooms, ductwork and the cooling tower from the new roof, which would normally have provided a possible alternate solution to the severe space conditions.

3) Another complication was introduced by the fact that the new addition is partially located on a flood plain. The recorded high level of surface water therefore imposed a limitation as to the lowest permissible elevation of the ground floor of the building. This condition had a bearing on another aspect of the problem – namely, elimination of the conventional use of crawl space, tunnels and trenches below the ground floor for horizontal duct distribution to alleviate headroom conditions in the building. Such trenches and tunnels had to be completely water-proofed and were therefore kept to a minimum because of cost and maintenance considerations.

4) Further, arrangement of the spaces was such that no permanent central corridor or "core" existed, which would have permitted limited lower ceilings

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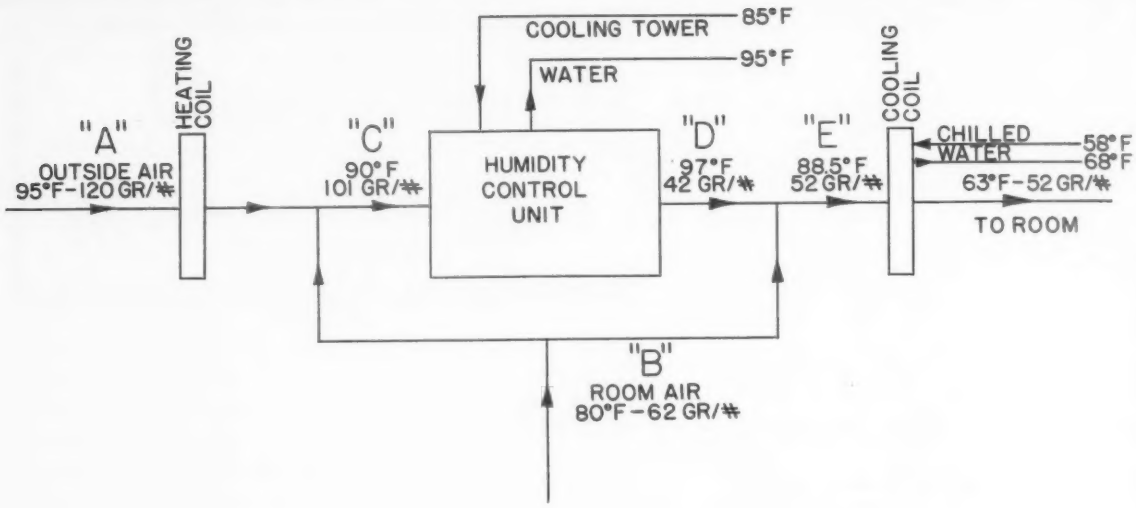

Fig. 1: *Schematic diagram of summer cycle.*

(Continued from preceding page)

for the running of major ducts, with branches to the individual spaces. Melpar's diverse activities and their need for continued partition rearrangement necessitated design of a modular system of duct distribution throughout the building and further required provisions for individual control of these modules.

Preliminary Investigations

In preliminary stages of the design, the usual and conventional systems of air conditioning were considered and fully investigated. Conventional low pressure all-air systems had to be discarded almost immediately because of the unworkable space conditions.

One alternative, of the many considered, to the problem of headroom caused by the large ducts of a low-pressure air system would have been the use of a considerable number of localized fan rooms scattered throughout the building. This was studied and proved to be extremely uneconomical of space and impractical from a functional standpoint.

High pressure dual duct and single duct systems were investigated next. Here again, space conditions floor-to-floor posed an insurmountable problem due to the required depth of mixing and sound attenuation boxes and the unavoidability of crossovers of large diameter ducts.

A number of variations of each of the above systems, including perimeter high velocity induction units and fan-coil units, heat pump units and others, had to be discarded for much the same reasons. For example, perimeter induction units would have required a large tunnel under the entire periphery of the building. As explained previously, such tunnels had to be avoided or at least kept to a minimum because of the water condition.

At the completion of all of these investigations and studies it became apparent that the solution would lie in drastically reducing the air quantities, thus directly alleviating the main problem of placing ducts within the available headroom. In order to achieve such a reduction of air quantities, a system utilizing the radiant principle to handle the major portion of the cooling load was indicated.

The radiant system selected was a ceiling system. With the use of this system, ductwork could, in general, be reduced so as to handle only the air required for ventilation, and that amount will generally carry the space Latent Load. To complement this system, the central air supply was designed to incorporate a chemical humidity control system.

The Actual Solution

The radiant system is based on the use of radiant-acoustical ceiling panels, attached to a network of pipe grids. The panels are constructed of perforated aluminum and so designed that they are in continuous contact along their edges with the pipes of the grid. Thus, the entire panel is cooled or heated by conduction and can act as a radiant surface.

The ceiling system is provided with blanket insulation over the entire pipe-grid network; this enables the system to act as an acoustical ceiling as well. The system of pipe grids is supplied with either chilled or heated water as required.

Each grid is set up on a module basis, with some sub-divisions of modules where partitions necessitate smaller units. A single grid can be individually controlled as desired. At present, control zones are set up by floors and by exposures, with major areas under individual control. However, provisions have been made for future individual control of any selected grid.

With all-air systems of the types considered, future individual zone control would have been virtually impossible to achieve. Actually, one of the factors weighing against the selection of these other systems was that in attempting to provide a proper

degree of control in individual zones or areas, the problem of headroom would have been aggravated due to the requirement for reheating or recooling coils within the allowable headroom areas.

Another feature of the system as designed lies in its unique potential for adapting to future load variations. The number of pipes in each grid was deliberately increased to the maximum, so that in practice the sum of the cooling capacity of the air and of the ceiling panels exceeds the actual load.

Balancing Cocks Provided

Balancing cocks are provided at the grid connections so that the grid capacity can be adjusted to the present load. In case of future load variations these cocks can be readjusted as required. This same analysis applies to future partition changes, in conjunction with the provision for future individual grid control.

The reduction of air quantities also had an effect in the reduction of potential system noise. The lighting and equipment loads, coupled in some instances with a very large amount of fenestration, resulted in some spaces in air changes of more than 15 per hour. With the relatively low ceiling heights which were established, such high air changes constituted a considerable problem in air noise potential and also a potential source of trouble with respect to drafts.

While attempts could always be made to eliminate these problems in any specific instance, it was practically impossible with these high air change rates to make such provisions for a partition arrangement and for loads which were flexible and subject to future change. By means of the considerable reduction of air quantities, these conditions were vastly improved, so that noise and drafts no longer represent unmanageable conditions.

The humidity control system consists of lithium chloride brine spray units to treat the outside air. (This method of humidity control provides the finest degree of humidity control for the greatest range of relative humidities). By means of special control of the concentration of the solution, these units can either *add or extract* water vapor from the air. The system has automatic provisions for continuous regeneration of the desired LiCl concentration, so that it may be re-used without loss.

By means of an oversized cooling tower, the system is able to use cooling tower water for partial cooling in connection with the humidity control system. This means an approximate 20 percent reduction in overall tonnage of the refrigeration compressor. The system further reduces compressor capacity requirements by providing dehumidification without the need for overcooling and reheating the supply air.

This method of humidity control was chosen also because it can be readily adapted to future changes in humidity requirements without major modifications to the system.

Air quantities for the supply systems are generally those required for good ventilation. In certain instances, they are increased to supplement the cooling load requirements of the space. The air is filtered and also cooled or heated as the seasons may require. A return and exhaust air system is provided for economy of operation. Quantity of outside air introduced to the system can be varied to provide maximum economy during intermediate seasons.

Refrigeration is supplied by an electrically driven 400 ton hermetically sealed centrifugal compressor with condenser and cooler for producing chilled water. An exterior ground level cooling tower is provided for condenser water (also providing cooling for the humidity control system). Provision is made for late-season operation of the cooling tower by means of steam heating to prevent freeze-up.

Automatic Temperature Control

The greatly diversified requirements of the various spaces within the building required a control system which was capable of automatically providing

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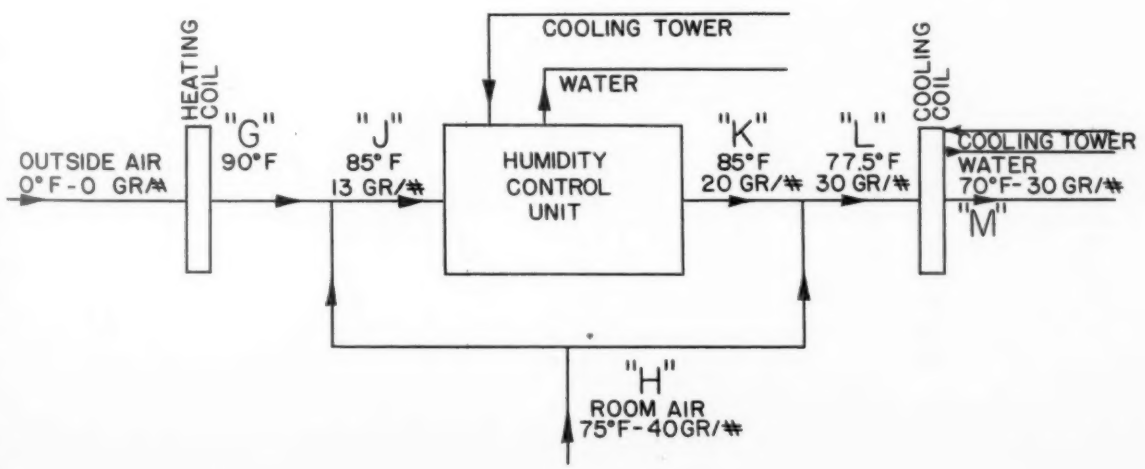


Fig. 2: *Schematic diagram of winter operating cycle.*

PSYCHROMETRIC CHART

Normal Temperatures

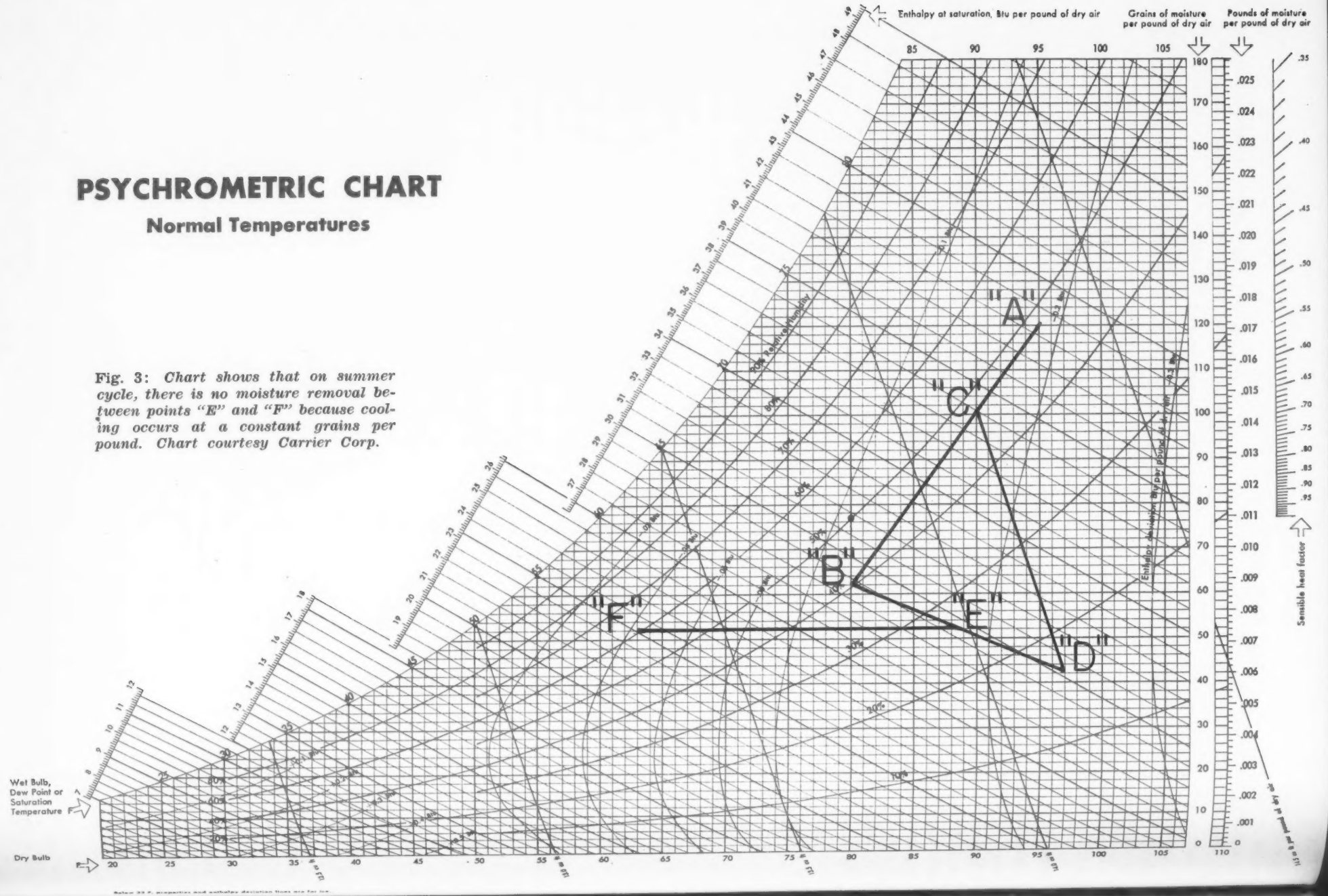
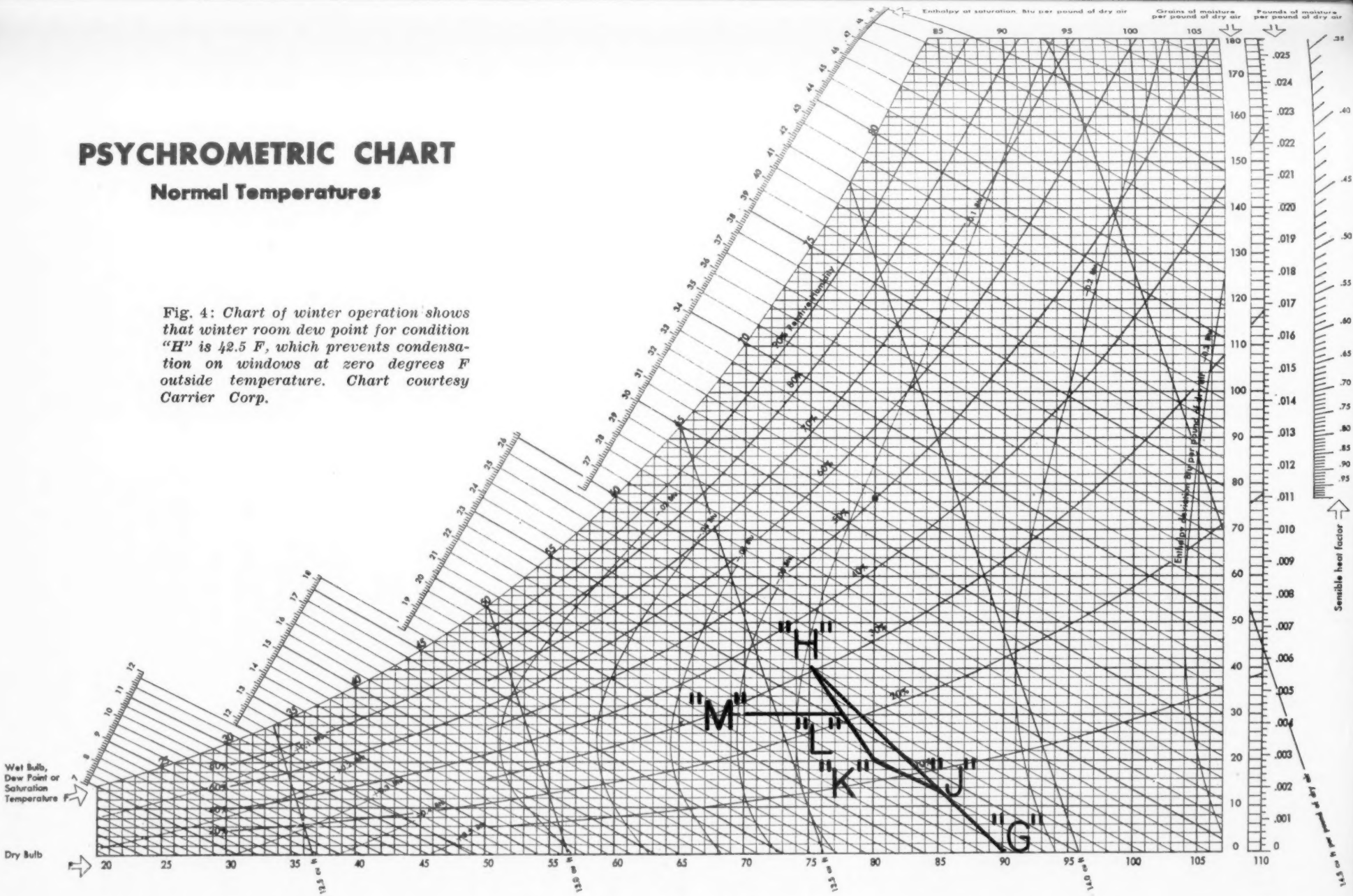


Fig. 3: *Chart shows that on summer cycle, there is no moisture removal between points "E" and "F" because cooling occurs at a constant grains per pound. Chart courtesy Carrier Corp.*

PSYCHROMETRIC CHART

Normal Temperatures

Fig. 4: *Chart of winter operation shows that winter room dew point for condition "H" is 42.5 F, which prevents condensation on windows at zero degrees F outside temperature. Chart courtesy Carrier Corp.*



Below 32 F. properties and enthalpy deviation lines are for ice.

Heat Transfer In Ductwork

by C. O. Wood
Manager, Engineering Laboratory
Westinghouse Electric Corp.
Sturtevant Div.

When designing a comfort system don't overlook problems raised by heat transfer through duct sides, condensation, and alternate heating and cooling. Here are ways to avoid them.

HEAT FLOW THROUGH DUCT SIDES can be an important item in the over-all system performance. In addition to increasing the system heat load unduly, a poorly designed system can radically affect the comfort in surrounding spaces and also increase maintenance problems due to condensation.

Outlined below are the major criteria involved in the flow of heat through duct walls.

Heat losses or gains in ductwork follow normal heat transfer criteria where the air is moving in turbulent fashion on one side and is reasonably still on the other side.

The amount of heat transferred is given by the formula: $Q = U A \Delta t$

Where Q is Btu/hr

U is the over-all coefficient determined chiefly by the air velocities inside and out and by the duct material. Btu/hr/ft²/°F t is the over-all temperature difference between the air on both sides of the duct, °F

A is the area of the duct surface in square feet. This is the average area perpendicular to heat flow and is equal to

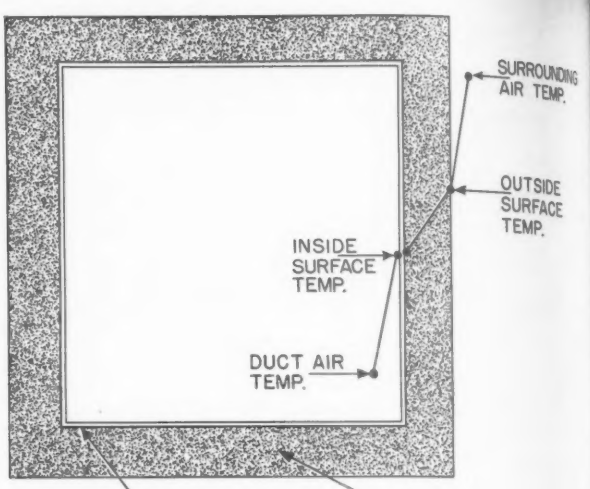


Fig. 1: *Temperature distribution through an insulated duct wall at equilibrium conditions.*

$$\frac{A_1 + A_o}{2}$$

The coefficient U is made up of the individual coefficients of the materials and surfaces in the path of the heat flow:

$$U = \frac{1}{\frac{1}{h_1} + \frac{1^m}{k_m} + \frac{1_i}{k_i} + \frac{1}{h_2}}$$

where h_1 = inside surface coefficient Btu/hr/°F/ft²

1_m = metal thickness, in

k_m = metal conductivity Btu/hr/ft²/°F/in thickness

1_i = insulation thickness, in

k_i = insulation conductivity Btu/hr/ft²/°F/in thickness

h_2 = outside surface coefficient Btu/hr/ft²/°F

The heat loss or gain on uninsulated metal duct is usually about 2 Btu/hr/ft²/°F while that in a duct insulated with one inch of insulation will be about 0.3 Btu/hr/ft²/°F. However, these values can vary widely and the designer should calculate actual losses based on the particular construction used. Data on heat transfer coefficients can be found in the ASHRAE Guide or other heat transfer references.

The above formula is for rectangular ducts and for round ducts having a ratio of outside surface area to inside surface area of 2 or less. Small ducts having extra thick insulation may exceed this area ratio and in this case the logarithmic mean area should be used for greater accuracy.

The logarithmic mean area is:

$$A_{lm} = \frac{A_2 - A_1}{2.3 \log (A_2/A_1)}$$

The total heat loss from a given length of duct is:

$$Q = ULP\left(\frac{t_1 + t_2}{2} - t_3\right)$$

Where Q = heat loss through duct walls Btu/hr
U = over-all coefficient of heat transfer Btu/hr/ft²/°F
L = duct length, ft
P = perimeter of duct, ft.
t_1 = temperature or air entering duct, °F
t_2 = temperature of air leaving duct, °F
t_3 = temperature of air surrounding duct, °F

To find t_1 or t^2 the heat loss is equated to the heat given up by the air:

$$ULP\left(\frac{t_1 + t_2}{2} - t_3\right) = .24W\ (t_1 - t_2)$$

where: W = weight of air through duct, lb/hr
Specific heat of air = .24
This relation then develops to

$$t_1 = t_2\left(\frac{\frac{.48W}{ULP} + 1}{\frac{.48W}{ULP} - 1}\right) - 2t_3$$

and

$$t_2 = t_1\left(\frac{\frac{.48W}{ULP} - 1}{\frac{.48W}{ULP} + 1}\right) + 2t_3$$

Moisture condensation on duct and plenum surfaces is an important problem in air conditioning and refrigeration. Moisture will condense on any surface which is below the dew point temperature of the adjacent air.

The problem of preventing condensation, however, is not only that of maintaining satisfactory surface temperature but also includes the proper sealing of the surfaces to prevent moisture migration through the materials to the cold inner surface of the duct or plenum. The vapor seal is always placed on the warmer side.

The insulation covering must be applied with care so as to cover all cracks and holes on the outer or warmer surface. Any through metal parts such as bolts or flanges which extend close to the warmer surfaces will lower the temperature locally and may be a source of condensation trouble.

The extent of condensation prevention measures will depend on the severity of the application. The temperature difference between the duct air and the surroundings and the relative humidity of the surrounding air are the critical factors.

Fig. 2: ***A fan and plenum insulated with aluminum foil-type insulation.***

There are a number of preventive measures which can be used to reduce the condensation problem. These are listed below:

1. Provide ventilation either by natural means or by forced convection so that the moisture laden air in the surroundings is replaced with drier air.
2. Air condition the surrounding space. This may well pay for itself in savings on insulation and in improved working conditions in spaces such as equipment rooms.
3. Reduce the source of moisture by placing a vapor barrier such as asphalt paper or aluminum foil between the source and the duct. An example of this is crawl space where the damp ground can be covered to reduce the moisture evaporation.
4. Provide a porous surface on the cold side of the duct or plenum so that any moisture which passes the external vapor barrier will continue through and be carried away. Thus the moisture does not concentrate in the insulation.
5. Heat the surrounding space. This has the effect of raising the duct surface temperature above the dew point temperature. This corrective action has the disadvantage of increasing the heat flow into the duct or plenum.

To determine the surface temperature, the ratio of thermal resistances is used as follows:

$$\frac{t_1 - t_2}{t_1 - t_4} = \frac{R_{1\text{-}2}}{R_{1\text{-}4}} = \frac{1/h_{1\text{-}2}}{1/U_{1\text{-}4}}$$

(Please turn to following page)

where t_1 = warm side air temperature
t_2 = warm side wall temperature
t_4 = cold side air temperature
R_{1-2} = warm side surface resistance
h_{1-2} = warm side surface conductance
R_{1-4} = over-all thermal resistance
U_{1-4} = over-all thermal conductance

Applications which require alternate heating and cooling should include consideration of the specific heat of the materials used in the ducts or chambers. When comparing various materials for this use, a term called thermal diffusivity is used.

This is thermal conductivity divided by the product of specific heat and density (k/c_ρ). Cooling or heating time is directly proportional to the square of the thickness and inversely proportional to the thermal diffusivity.

Thus time is proportional to $l^2 \times \frac{1}{k/c_\rho}$

The calculation of actual time of cooling and heating is accomplished by a number of different methods including the Schmidt Method, electrical analogies, and Gurny-Lurie charts. The reader is referred to the various heat transfer references for these methods. ▲▲

SUGGESTED REFERENCES

ASHRAE Guide: American Society of Heating, Refrigerating & Air Conditioning Engineers, N.Y.C.

ASRE Data Book: American Society of Heating, Refrigerating & Air Conditioning Engineers, New York City.

G. B. Wilkes: *Heat Insulation,* John Wiley & Sons, N.Y.C.

W. H. McAdams: *Heat Transmission,* McGraw Hill Co., New York City.

Fishenden & Saunders: *The Calculation Of Heat Transmission,* His Majesty's Stationery Office, Eng.

Ingersoll & Zobel: *Heat Conduction,* McGraw Hill Co.

Jakob & Hawkins: *Elements Of Heat Transfer & Insulation,* John Wiley & Sons, New York City.

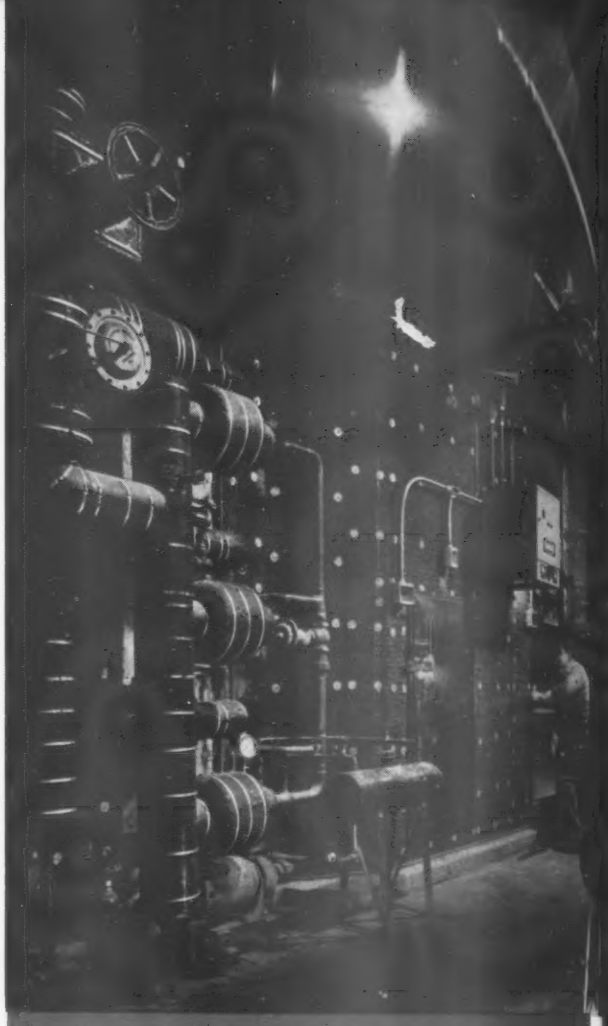


Fig. 4: *A filter and coil plenum during the construction stage showing wire mesh covering the cold pipe insulation.*

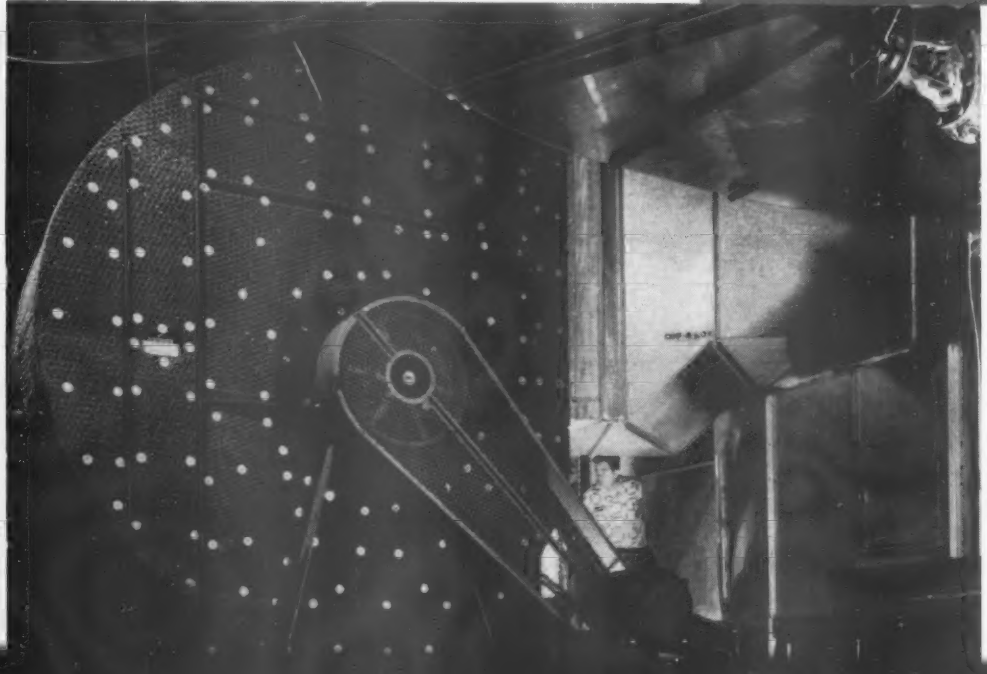


Fig. 3: *A fan and duct system during installation of insulation. The wire mesh will be covered with a final finished layer of insulating material.*

New Literature

Industrial Dryer and Oven Bulletin

Four page bulletin ID-300 illustrates typical installations for paint baking, heat treating, rubber, plastics and ceramic curing and many other similar applications. Shows are typical oven material handling set-ups.

Source: *J. O. Ross Engineering, Div. of Midland-Ross Corp., Dept. AE, 730 Third Ave., New York 17, N. Y.*

Corrosion Resistance Chart

Four-page Corrosion Resistance Chart J-CRC lists over 150 different chemicals and their recommended usage with ductile iron, iron, steel, 316 and 304 stainless steel, monel, brass, bronze, copper, aluminum and plastisol plastic.

Chart also shows which gasket materials are needed for the various chemicals when Kamlok Quick Couplers are used and which O-ring materials are needed when swivel joints are used with these chemicals and compounds.

Source: *OPW-Jordan, Dept. AE, 6013 Wiehe Road, Cincinnati 13, Ohio.*

Bibliography on Filing System For Engineers

This is a selected list of references prepared for engineers and librarians concerned with organizing their own files or the files in the engineering offices.

References are to books, pamphlets and magazine articles on filing, classifications and indexing, lists of subject headings, and hand-sorted punched-card systems suitable for organizing small collections of engineering books, notes, correspondence, abstracts, reprints, drawings, maps, manufacturers' catalogs, etc. Price $2.

Source: *Engineering Societies Library, Dept. AE, 29 West 39th St., New York 18, N. Y.*

Mechanical Estimator's Guide

New guide, claimed to be first of its kind published, contains classified and verified labor and material cost data required for estimating air conditioning jobs of all descriptions.

Pricing data includes labor and materials for such items as cooling towers, water chillers, walk-in coolers, service reserves, piping, grilles, filters.

The 56-page guide, edited by John Gladstone, is priced at $6 per copy.

Source: *Technical Guide Publications, Dept. AE, 224 N.E. 59th St., Miami 37, Fla.*

EXECUTIVE REPORT #4

HEALTHY MOTORS BREATHE ULTRA-PURE AIR

...cleaned by **WHEELABRATOR**® air filters

Your investment in steel making equipment is too big to take a chance on motor failure resulting from dust in the atmosphere. Especially when Wheelabrator Ultra-Filtration air filters can provide essential air purity at minimum cost.

In prominent American and Canadian steel plants, Ultra-Filtration today is providing over 5,000,000 cfm of super-clean air for motor rooms, control rooms, electrical equipment and turbo blowers.

The low cost of operating Wheelabrator Ultra-Filtration air filters is gratifying, too. No liquids, oils or tacky materials are involved — there is no problem of sludge removal. In one typical installation, *absolutely* no maintenance cost has been experienced in filtering over 394,000 000,000 cf of air.

Ultra-Filtration provides any degree of air purity you require, at minimum cost

Ultra-Filtration delivers collection efficiencies above 99% by weight and 95% by blackness test, even when filtering sub-micron size particles. For illustrations of highly efficient Dustube installations, write for Catalog 562-D. Wheelabrator Corp., 498 S. Byrkit St., Mishawaka, Ind. In Canada, P. O. Box 490, Scarborough, Ont.

WHEELABRATOR
DUST AND FUME CONTROL

New Appointments

Robert A. Wasson has been elected president and general manager of the Clarage Fan Co. Wasson, who has been vice president and general manager since 1945, succeeds Harry R. Clarage, who died suddenly on Dec. 26, 1959. Wasson has served two terms as president of the National Association of Fan Manufacturers, as well as serving on the board of directors and several committees of the Air Moving and Conditioning Association.

R. A. Wasson

Bohdan G. Passty has assumed the post of development engineer in charge of Humphrey heating division of Arkla Air Conditioning Corp.

B. G. Passty

Passty, a veteran in the heating, air conditioning, and refrigeration field, was born in the Russian Ukraine, came to Canada in 1948, and the United States in 1957. He resided in the South until taking his present post with Arkla.

Buffalo Forge Co. has announced the election of **Theodore M. Dillaway** as vice president and **George P. Schivley** as vice president of manufacturing. Dillaway continues as director and secretary. Schivley has been director of manufacturing since 1955. He is also a director of the company.

G. Johnson, Jr.

Buffalo Forge also announced the appointment of **Glenn H. Johnson, Jr.** as Buffalo district sales manager to succeed **Roswell Farnham** who retired after 46 years with the firm. Johnson was previously a sales engineer for the company in Philadelphia.

R. Farnham

Appointment of **Louis S. Oosten** as vice president in charge of engineering for Bell & Gossett Co. was announced by R. E. Moore, president. Oosten succeeds **Harold A. Lockhart** who recently passed away. Oosten has been plant superintendent since 1953. He was previously assistant to the chief engineer.

L. S. Oosten

The Ceilcote Co. has announced the appointment of **D. K. Kauffman** to the position of manager of manufacturing.

D. Kauffman

In his new position Kauffman will be responsible for all phases of management of the company's two manufacturing divisions. He was formerly plant manager of the company's Plastics Div.

Board of directors of Walton Laboratories, Inc. has announced the election of **John B. Feldermann** to the presidency of the humidifier manufacturing firm.

J. Feldermann

Active with Walton for more than 12 years, Feldermann has previously held positions in the purchasing, production, accounting and advertising departments. Sales manager since 1957, he succeeds his father, the late William Feldermann, in the presidency.

C. Milton Wilson has been appointed general sales manager of Recold Corp.'s Air Conditioning Div. Wilson will coordinate and direct the sales of Recold's air conditioning products. He was formerly general sales manager of Anemostat Corp. of America.

C. M. Wilson

Adolph R. Schaub has been named manufacturing manager of the L. J. Wing Mfg. Co., a division of Aero Supply Mfg. Co., Inc. Schaub comes from M. W. Kellogg Co., where he served in project engineering, purchasing, and production management capacities. Most recently he was production manager and shop superintendent.

A. R. Schaub

Trane Co. has announced the appointments of:

William G. Barnard as manager of Trane's Des Moines sales office, replacing **Tracy Johnson,** who has retired after 45 years with the company. Barnard has been a sales engineer in the Des Moines office since 1950.

W. G. Barnard

Thomas Shimanski as manager of the Madison and La Crosse, Wis. sales offices, replacing his father, **V. E. Shimanski,** who retired Jan. 1 after 34 years with Trane. The younger Shimanski has been with the Trane sales organization since 1948.

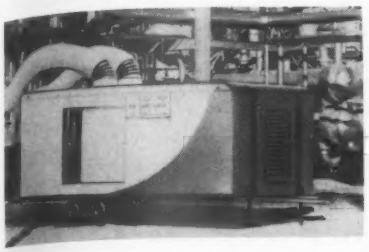
Stone & Webster Engineering Corp. has recently appointed **John J. Niland** as assistant engineering manager. He has been in engineering administration with the company since 1956 and has also served as assistant to the president of Associated Nucleonics, Inc., a subsidiary.

A. O. Jaeckel has been elected vice president of Tube Reducing Corp., Wallington, N. J. and general manager of that company's Davis Engineering Div.

A. O. Jaeckel

Jaeckel joined the original Davis Engineering Corp. in sales work, in 1926. He became general manager in 1945 and president in 1952.

New PRODUCTS



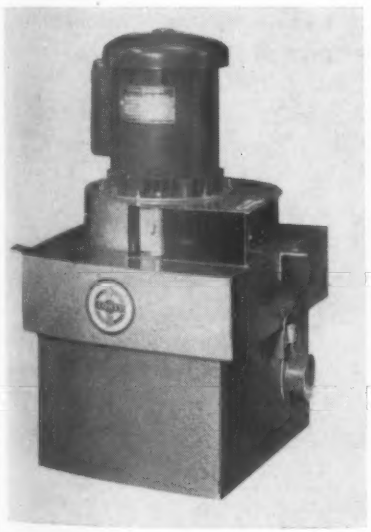
Portable Air Conditioner-Heater-Ventilator

Purpose: For space cooling and heating areas during construction or in emergencies.

Features: Completely portable with plastic ducts. Mounted on wheeled frame. Requires no skilled personnel.

Standard ratings are 600,000 Btuh for cooling, dehumidifying; 1,200,000 Btuh for heating; 18,000 cfm for ventilating. Available on rental or lease basis.

Source: Ready Cool, Inc., Dept. AE, American Bank Bldg., New Orleans, La.

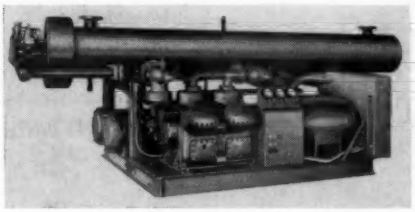


Low Cost Dust Collector

Purpose: Dust collection in light manufacturing operations.

Features: Model 301 stands 21½ in. high and occupies a space of 12 by 14 in. Filter media is fire-resistant and of throwaway glass type. Performance is rated at 300 cfm, 4100 fpm velocity, 1.7 in. w.g. static pressure, and 3 in. inlet. Equipped with ⅓ hp motor. Price $138 FOB St. Paul.

Source: Torit Mfg. Co., Dept. AE, 1133 Rankin St., St. Paul, Minn.



Packaged Liquid Chiller

Purpose: For use in air conditioning and process cooling systems.

Features: Compact chillers range from 75 through 125 hp in the direct drive compressors and 7½ through 60 hp in the semi-hermetic type.

All components are matched, factory engineered and tested, and shipped completely assembled.

Source: Curtis Mfg. Co., Refrigeration Div., Dept. AE, 1905 Kienlen Ave., St. Louis 33, Mo.

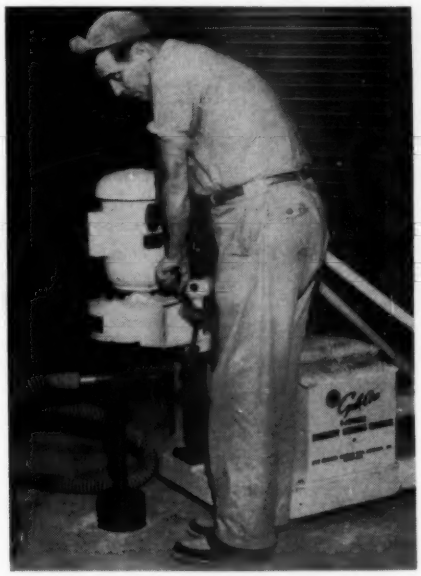
New Air Sanitizer

Purpose: Controlling malodor of air at the source.

Features: Turgasept preparation is available in either aerosol spray or concentrate. Product is sterile, bactericidal, and fungicidal.

Can be purchased in 16 oz. can or in bottled concentrate.

Source: Turgasept Co., Dept. AE, 505 Fifth Ave., New York 17, N. Y.

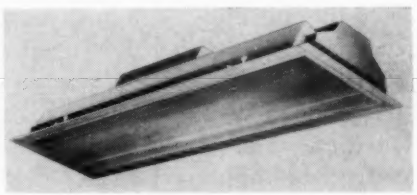


Portable Masonry Drill

Purpose: Drill openings in reinforced concrete.

Features: New "Method A" driller contains its own Cyclo-core Bits, dust exhaust swivel, power unit, and dust collector. Only one man required for operation. Can be used in areas where dust occurrence during operations would be prohibitive.

Source: New England Carbide Tool Company, Inc., Dept. AE, 55 Commercial St., Medford 55, Mass.



Combination Light and Air Diffuser

Purpose: Facilitate layout problems by combining fixture and diffuser in one unit.

Features: Available in two sizes. 1 ft by 4 ft troffer or 2 ft by 4 ft Mobilex. Air is diffused through slots along both sides of light fixture and can be adjusted by accessible cone damper.

Source: Barber-Colman Co., Dept. AE, 1300 Rock St., Rockford, Ill.

(Please turn to page 53)

Industry Looks at Air Pollution

(Continued from page 21)

come at a more rapid pace when the general public and industry work together and when common sense replaces emotion and hysteria. It is presumptuous for one person to speak for all industry on the subject of air pollution, but it is possible to assess what industry is doing today. Here are a few examples:

One industry was confronted with an air pollution problem of a very disagreeable mercaptan-like odor that included traces of aniline and benzene vapors, along with the complex sulfur compounds. The odor constituents were residual in the product and escaped from several process steps including drying. Sampling of the process vent stack gases revealed the nature and quantity of the offensive substances.

It was apparent that steam stripping followed by condensing would remove most of the offensive materials and that the noncondensable substances could be burned in a flare. *A $35,000 control installation applied to the first stages of the process paid for itself in one year through the recovery of valuable chemicals.* Most air pollution control installations do not pay for themselves; nevertheless, industry today is proceeding at a rapid pace in its efforts toward the abatement of air pollution.

One of the reactions involved in the production of a chemical dye at one plant gave off chlorine gas as a by-product. The venting of this chlorine resulted in an air pollution problem and was abated by the use of a different oxidizing agent.

Examples Should Be Multiplied Hundreds of Times

Multiplying these examples hundreds of times reflects the ingenuity of industry. An ammonia scrubbing process has been developed and applied to the removal of sulfur dioxide and sulfuric acid mist given off from plants manufacturing sulfuric acid. This process converts the objectionable effluent materials into usable products. However, capital cost of the control installation is extremely high, in fact one such installation cost over a million dollars.

In the petroleum refining industry, hydrogen sulfide gas, formerly either discharged to the atmosphere or flared, may now be converted to free sulfur by the Claussius process of controlled oxidation and catalytic reaction. One small unit, capable of handling twenty-five tons of H_2S per day, is estimated to cost $250,000. The economics of the process are such that it operates at a profit.

Floating tops for petroleum storage tanks are now utilized to prevent evaporation of hydrocarbon vapors which otherwise would escape to the atmosphere from vented solid head tanks. This industry is spending almost a million dollars a year to learn more about the chemistry of the atmosphere.

Sulfur dioxide gas that was formerly discharged to the atmosphere as a waste product from the roasting of sulfur-containing ores is now being utilized by the smelting industry in the production of sulfuric acid. Catalytic combustion has been successfully used to burn high concentrations of solvent vapors formerly given off from such processes as baking enamels on wire and baking paint on cedar shingles. The heat produced by this burning in one case furnishes a large percent of the heat required for the baking ovens.

Control Costs Run High In Steel Industry

In the steel industry, costs of air pollution control are exceedingly high. It has been reported that an expenditure of nearly one-half million dollars is needed to make an open hearth furnace dust free. However, the steel industry has not been idle with respect to air pollution control. They have spent many millions of dollars for dust and gas trapping equipment and must be highly commended for their efforts. In addition, the industry is supporting a large program of research on air pollution control. This is entirely voluntary. As a result of this research, pilot plant studies on air pollution abatement are underway. The results are extremely promising.

At one steel company, an extensive fluoride research and control program had just been completed. About 95 percent of the fluoride in the ore was released in stack gases from ten open hearth furnaces and from the sintering plant. Conventional scrubbing methods proved unsatisfactory due to destruction of equipment by hydrofluoric acid and the problem of disposal of large amounts of wash water high in hydrofluoric acid.

The control method adopted involved the use of calcium hydroxide. In the sintering plant, lime chips are added to the ore and the exhaust gases are treated with lime in steam and wash water. Particles remaining in the gas are removed by electrostatic precipitators. Collecting equipment removes not only the calcium fluoride but also all other solids present in the gas. The end result has made this plant one of the cleanest operating steel plants in the world.

Studies are continuing on an elaborate scale to prevent the dispersal of gaseous effluents from nuclear power plants. Such wastes, of course, differ from general air pollutants in that there is a possibility they might contain radioactivity. Here again, considerable sums of money and technological effort have been concentrated on the control of these potential contaminants.

Our problem in the more urban centers is for the private citizen, the municipal government and industry to learn to live together. The history of litigation over air pollution nuisances in the United

(Please turn to page 62)

New PRODUCTS

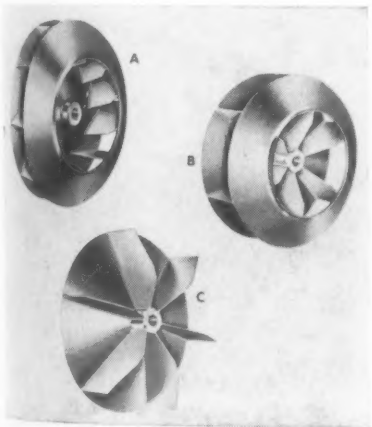
(Continued from page 51)

Halogen Leak Detector Kit

Purpose: Locating refrigerant leaks in contaminated atmosphere areas.

Features: Kit consists of Type H-6 leak detector, with newly designed proportioning probe, and a Type LS-20 leak standard. Standard is included for calibrating and checking detector sensitivity.

Source: General Electric Co., Dept. AE, Schenectady 5, N. Y.



New Industrial Fan Line

Purpose: Material handling, gas, fume, and industrial applications.

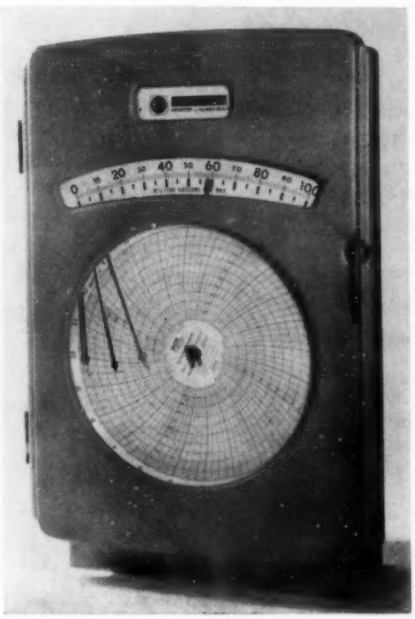
Features: New line covers three basic wheel designs and sizes in AMCA standards from 19⅛ to 64⅜ in. Ratings are also certified by AMCA. Wheels are balanced and close tolerances are kept on the shafts.

Source: The Trane Co., Dept. AE, LaCrosse, Wis.

Correction

In announcing the new Dustex Roto-Jet cloth dust collector in January, it was stated that single units were available in three sizes: small up to 1,000 cfm, medium up to 1,500 cfm, and large up to 2,000 cfm. The story did not indicate, however, that multiples of these units will handle any volume desired, i.e., 10 large units in series have a capacity of 20,000 cfm.

Further information may be obtained from Dustex Corp., P. O. Box 2520, Buffalo 25, N. Y.



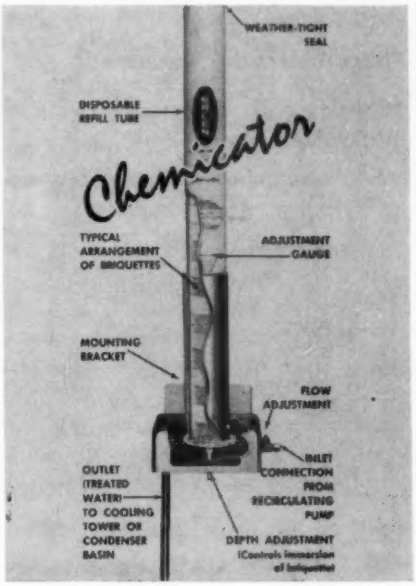
Recorder-Receiver Instrument

Purpose: Maintain positive control of materials in motion.

Features: Instrument can be operated either remotely or in plant. Includes faster, quieter positioner with 2, 4, 8, 15, and 60 second time-cycles.

Panel is of the swing-out type, and of modular construction.

Source: B-I-F Industries, Inc., Dept. AE, 345 Harris Ave., Providence 1, R. I.



Chemical Controller for Cooling Towers

Purpose: Feeds balanced chemical treatment into circulating water systems.

Features: "Chemicator" consists of a tube having polyphosphate and organic chelate briquettes which pass on to the recirculating water. No moving parts to wear and operation is automatic.

Unit sells for approximately $20 F.O.B., Burbank. Installation averages about $5.

Source: Erlen Products Co., Dept. AE, Burbank, Calif.

Nylon Coveralls

Purpose: For use in white rooms and sterile laboratories.

Features: Garments are made from lint-free white nylon pack cloth and available with plastic buttons, or zipper front closure.

Attached boots can be furnished with sole of three ply nylon and cross-stitched for strength.

Source: M. Setlow & Sons, Inc., Dept. AE, 131 Chestnut St., New Haven, Conn.

(Please turn to following page)

Use Communications Center, page 37, for requesting more information about articles, advertised products, literature, etc.

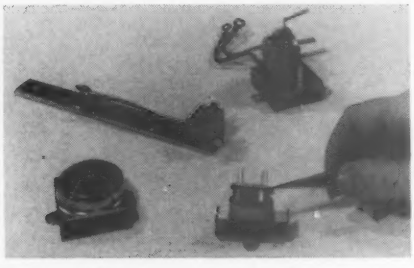
New PRODUCTS

(Continued from page 53)

Thermoelectric Modules

Purpose: To cool industrial and military electronic equipment.

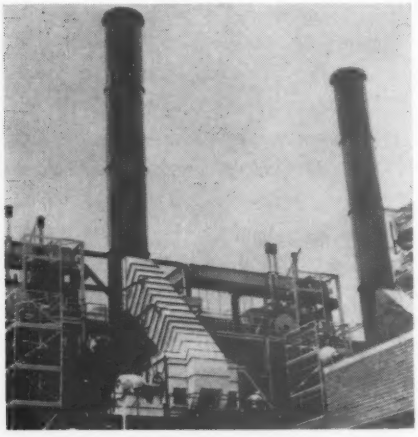
Features: Modules come in various shapes and sizes. Can be



mounted in any position when used with transistors, diodes, and other components.

Excellent for use in compact areas where silent operation is required.

Source: Westinghouse Electric Corp., Dept. AE, Box 2278, Pittsburgh 30, Pa.



Glass-Protected Smokestacks

Purpose: Minimize smokestack failures that are caused by corrosion.

Features: Stack is painted inside and out with acid resistant glass, providing three to five times longer life than conventional steel stacks.

Now available in custom-blended colors as well as black or blue.

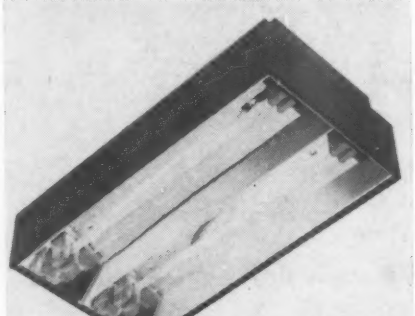
Source: A. O. Smith Corp., Dept. AE, Process Equipment Div., Milwaukee 16, Wis.

Battery Operated Air Sampler

Purpose: To test air samples in areas where no power lines are available.

Features: Completely portable and accurate. Simple operation of unit enables long service life of the battery. Choice of battery and filter collector is available.

Source: Gelman Instrument Co., Dept. AE, 106 N. Main St., Chelsea, Mich.



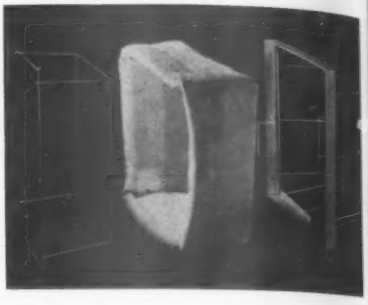
New Infrared Heating Unit

Purpose: Indoor-outdoor radiant heating.

Features: High-efficiency reflector is used with tubular quartz infrared lamps enabling the unit to project 85 percent of the lamp heat to the heated area.

Units are available from 500 to 15,000 watts; and lengths from 10½ to 55½ in.

Source: Luminator, Inc., Dept. AE, 120 N. Peoria St., Chicago 7, Ill.



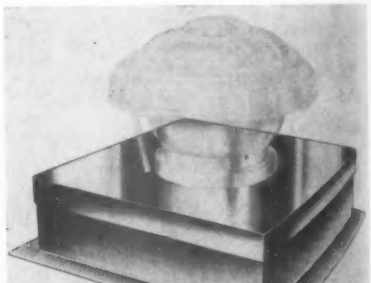
Cube Shaped Air Filter

Purpose: For use in commercial and industrial air conditioning, heating, dust entrapment, and process air systems.

Features: Shaped like an open box, ULOK combines high efficiency with low pressure drop. Media is made of 2 in. Dynel modacrylic filter batt. Unit is listed by UL as Class II.

Manufacturer claims service life six times longer than that of other filters.

Source: Union Carbide Development Co., Dept. AE, 230 Park Ave., New York 17, N. Y.



Sound Control Curb

Purpose: Used for installing ventilators in areas where noise suppression is a critical factor.

Features: QT curb reduces exhauster's sonevalue by approximately two thirds. High frequency noises are eliminated and unit is thermo-insulated to prevent condensation.

Four sizes are available.

Source: Jenn-Air Products Co., Inc., Dept. AE, 1102 Stadium Drive, Indianapolis, Ind.

Radiant Heating and Cooling

(Continued from page 43)

full heating, full cooling or some intermediate position in each zone *regardless of the requirements of the other zones.*

Action of the control system in a typical zone is as follows: When the zone thermostat calls for maximum cooling, the zone 3-way valve supplies full cooling with 58F water to the grids in that zone. As demand for cooling decreases, the zone 3-way modulating control valve blends water from the chilled water supply main and zone return water to gradually raise the temperature of water supplied to the grids. When the 3-way valve is in full by-pass position, two position 3-way valves change over supply of water to the zone from chilled water to hot water and the action of the thermostat on the zone 3-way valve is changed from reverse acting to direct acting.

On demand for heat in the space, the zone 3-way valve modulates from by-pass position toward open position so that a full flow of hot water can be provided when the zone thermostat calls for maximum heating. On a demand for less heat the entire sequence is reversed.

Control provisions were made so that the pressure in the hot and cold water supply mains remains constant no matter what the demands of the fourteen main zones of control are. A dew cell control was provided in the return air to override temperature control of the chilled water supply main so that there would be no possibility of forming condensation on the radiant ceiling panels. This is actually a safety feature in the event of malfunctioning of the control system, since the basic design is predicated on avoiding such condensation under all conditions of normal operation.

By virtue of a room air dew point design of 54F and a panel design temperature of 63F and higher, a safe margin is accomplished. Moreover, it is considered safe to have the water temperature drop to within two degrees below room air dew point without danger of condensation.

The temperature control system is automatic and will change itself over for the most economical operation of the system as determined by outdoor temperature without supervision of the operator. At the same time, it provides safety protection for the major components of the air conditioning system.

Schematic Description

The cycle of operation of the air side of the system is shown diagramatically in the accompanying charts. Referring to Fig. 1, for summer operation, outside air at 95F and 120 grains per pound mixes with room return air at 80F and 62 grains to produce mixture "C", 90F and 101 grains. This mixture enters the lithium chloride unit, where it is dried, with a 7° increase in dry bulb temperature. Heat is removed by cooling tower water. It leaves at 97F and 42 grains, mixes with more return air to produce mixture "E", 88.5F and 52 grains.

Mixture "E" enters the cooling coil and leaves at 63F and 52 grains. Referring to Fig. 3, where this cycle is shown graphically on the psychrometric chart, note the following, (Fig. 3 is on page 44):

1) There is no moisture removal between "E" and "F" as this cooling occurs at a constant grains per pound.

2) With an enthalpy at "A" of 41.9 Btu per pound and at "E" of 29.6 Btu, it can be seen that considerable heat removal is accomplished before the air enters the cooling coils.

3) The heat removal effect of the lithium chloride unit and cooling tower water combined can be seen in the enthalpy reduction between entering condition "C" of 37.7 Btu and leaving condition "D" of 30.1 Btu.

In these charts, outside air constitutes approximately one third of the total supply air as at "F", and the amount of air passing through the lithium chloride equals one half of the total supply air.

Winter Operation

During winter operation, as shown in Fig. 2, outside air at zero degrees F and negligible moisture content is first heated to 90F and mixed with room air at 75F and 40 grains per pound. The resulting mixture "J" at 85F and 13 grains passes through the lithium chloride unit and leaves at 80F and 20 grains.

This air then mixes with additional return air, to form mixture "L" at 77.5F and 30 grains. This mixture, which is still too warm to be sent to interior rooms which may require cooling even in winter due to occupancy lighting and equipment loads is then sent through the cooling coil.

Cooling is accomplished by means of cooling tower water. Air leaves the cooling coil at 70F and 30 grains. Note following points as seen in Fig. 4, (on page 45):

1) In passing through the lithium chloride unit, "J" to "K", moisture is actually added (13 grains to 20 grains.)

2) Temperature decrease from "J" to "K" is due to the cooling effect of the cooling tower water.

3) The air is supplied to the room at a condition of about 10 grains less moisture than the final room condition. This is intended to correspond to the equivalent condition for the summer design. The system can also operate to supply either more or less moisture content than that shown, as required.

From Fig. 4, it can also be seen that the winter room dew point for condition "H" is 42.5F. This would be too high a dew point to prevent condensation on windows with a zero degree F outside temperature. The assumption therefore is that it may

(Please turn to page 58)

New DAY "RJ" Dust Filter

CONTROLS DUST SAVES DOLLARS

only 3 moving parts

Built under patents of The DAY Company and H. J. Hersey, Jr.

Because of its new, simplified design the DAY "RJ" dust filter will save you many dollars on initial investment, installation, operation and maintenance. Some of the important new construction features of this dust filter are: a new, quick-opening reverse-air, counter-flow valve for maintaining filter media porosity; a new, reverse-air pressure blower arrangement, and new, air tight, yet quickly opened inspection doors.

This patented DAY dust filter has only 3 moving parts but controls dust effectively, efficiently (99.99+%) and economically. It represents the latest refinement in a long-tested, plant-proven dust filter. Using felted filter sleeves to capture dust, the "RJ" is now available in 5 sizes for handling from 300 to 6400 CFM of air (for larger capacities, multiple groupings are furnished).

For more detailed information write toDAY for free Bulletin G-30. It's filled with facts, specifications and dimensions.

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EQUIPMENT . . . SYSTEMS . . . INSTALLATION

Air Conditioning Aids Storage of Sound Recording

A modern microgroove vinyl disk phonograph record of good quality should not suffer serious chemical deterioration in less than a century—and should be playable for that period, *provided* proper care is exercised, and storage is under optimum temperature and relative humidity conditions.

So states a study initiated by the Library of Congress and carried out at Southwest Research Institute at San Antonio, Texas, under a grant from the Rockefeller Foundation. The potential storage life of acetate records, used for instantaneous recording, was put at probably less than a half century under optimum conditions.

Libraries were advised to keep relative humidity in storage areas at 55 percent or less and temperature at or below 70 F for long-term storage. Both extremes of temperature and cyclic temperature changes were found to be damaging. Among other benefits of a proper ambient, it was reported, is that fungus growth was controlled.

Clean air is also important, as the researchers found that dust and grit are hazards, not only because of their abrasive action, but also for chemical and biological reasons. The report, titled Preservation and Storage of Sound Recordings, is available from the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C.

Villanova Offers Graduate Course In Air Pollution

Villanova university is offering a graduate course in air pollution this current school year. The course runs one night a week for two semesters. It is being taught by Robert A. Baker, a senior staff engineer of the Franklin Institute Laboratories.

Fall semester will cover the causes and effects of air pollution, and the spring semester classes will cover typical industrial problems and methods of treatment.

Use Communications Center, page 37, for requesting more information about articles, advertised products, literature, etc.

Plastics Industry

(Continued from page 33)

spot cooling registers.

The total air volume used for spot cooling amounted to 5560 cfm or 38 percent of the total of 14,720 cfm which was supplied to the room. This volume is in excess of the original design value and is due to subsequent increase in fan speed. The differential between exhaust and supply was further increased at a later date by the addition of a second supply air unit containing no heating coil and used only during the warm weather months.

It is rated at about 10,000 cfm of filtered air and serves to dissipate warm air by virtue of a rapid air change rate. The unit was located adjacent to the one already in use. The overabundance of supply air is dispelled through the gravity openings in the ceilings.

Needless to say, since the new ventilation system paid for itself in a matter of months, and saved about $25,000 the first year, management was somewhat more than satisfied. ▲▲

Respirators

(Continued from page 40)

stances. Included in this group are mercury, white phosphorus, tetraethyl lead, nickel carbonyl, arsine, the boron hydrides, phosphine, hydrogen sulfide, and the widely-publicized military "nerve gases." The initial action of most of these gases and vapors is primarily on the nervous system, respiratory arrest following.

If the above classifications appear complicated, it must be remembered that these air contaminants seldom occur alone, and that even less is known about the combined action of two or more substances, especially if they are in different groups, than of the individual substances. Even if particles in the air are non-toxic in themselves, they are known to act as carriers of condensable toxic vapors – formaldehyde can have its toxicity increased five times by the presence of an aerosol.

Respiratory Protection Complicated

It is little wonder, then, that respiratory protection can become a highly complicated subject, and that the practical application of respirators, gas masks, and self-contained breathing apparatus (all with their limitations), even by persons thoroughly trained in their use, is not cut-and-dried or foolproof. Relatively untrained persons in an emergency situation, the nature of which at the time is not exactly known, are in especially vulnerable positions.

Next instalment will discuss types and limitations of respiratory protective devices. ▲▲

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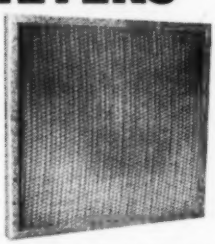

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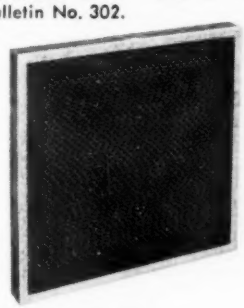

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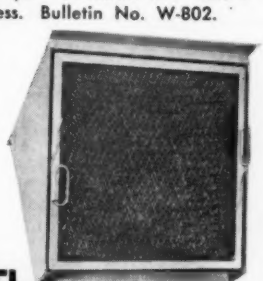

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Radiant Heating and Cooling

(Continued from page 55)

be necessary to maintain a lower dew point. However, it is worth noting that the use of a radiant ceiling for heating will result in a higher inside surface temperature for the glass than would be possible with more conventional systems. Consequently, a higher minimum indoor relative humidity is possible, resulting in greater comfort to the occupants.

Equipment Location

Virtually all of the mechanical equipment is located within a central, two-level machinery room. The equipment in this room includes boilers, supply fans, chiller unit, humidity control units, return fans, heating and cooling coils, pumps, heat exchangers, filters and control equipment. This centralized concentration of equipment will be of considerable importance in simplifying maintenance for the completed system.

The system described herein is the third largest installation of a combination heating and cooling radiant-acoustical ceiling in the United States. A very interesting and unusual feature is the combination of the radiant ceiling with a chemical humidity control system. Provision for individual control of the various pipe grids makes the system extremely flexible in terms of future partition changes and load variations.

The system also possesses an original feature in its application of cooling tower water. The cooling tower water is sent to the condensers in the usual fashion. However, a portion of it is also sent to coils in the LiCl units, to the main cooling coils and to a special heat exchanger. In the LiCl units, the water serves to offset heating effect of the regenerated solution.

Thus, air entering and leaving the LiCl unit is at essentially the same dry bulb temperature but has undergone a substantial reduction in moisture content. This reduction in moisture content represents an enthalpy loss of the air or, in effect, a saving of refrigeration tonnage. In this fashion the cooling tower water actually serves to reduce total tonnage.

In the main cooling coils, the water serves as a standby to the chilled water supply. During intermediate seasons the cooling tower water can thus be used for cooling. The special heat exchanger serves as a standby means of cooling the water supplied to the radiant ceiling and can thus also be used for cooling in the intermediate seasons.

The system as a whole provides a unique answer to the problem of conditioning a space with low headroom, high lighting loads, large glass areas varied exposures, heavy and diverse occupancies and humidity requirements. The solution proposes to accomplish these results with all possible economies of compressor horsepower and fan horsepower and a relative minimum of maintenance. ▲▲

CREDITS

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EQUIPMENT

Radiant Ceiling: *Burgess Manning Co.*
Kathabar Humidity Unit: *Surface Combustion Div., Midland-Ross Corp.*
Cooling Tower: *The Marley Co.*
Refrigeration Compressor: *York Corp.*
Boilers: *Titusville Iron Works Co.*
Roof Ventilators: *Davidson Fan Co.*
Automatic Temperature Control System: *Minneapolis-Honeywell Regulator Co.*
Supply and Exhaust Fans: *American Blower Co.*

Asks About Odors In Retread Plant

Question:

I have just received a complaint from one of our retread shops about bad odors. Do you know of any company that might provide some "perfume" to be added to the air to make it smell better, or possibly a washer that would launder the bad odors from the air?

L.G.G., Akron, Ohio

Answer:

The problem appears to be two-fold . . . 1) removal of particulate matter, products of combustion of latex and rubber. These must be handled by an efficient filter. 2) odors created by this process are of such intensity that it is not economical to handle by activated charcoal filters because the lack of air dilution would result in a fast saturation of the carbon. One way to handle this problem would be by a high stack exhaust. We doubt that there is a "perfume" strong enough to mask this odor. There is a possibility that wet scrubbing, through use of a wetted fiber unit for odor removal, may do the trick, and research is being done along these lines at this time.

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If you wish to contact manufacturers directly, street addresses are given. But please mention you saw it in Air Engineering.

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Air Pollution and Industry

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States has sponsored legislation dating back to the latter part of the nineteenth century. Chicago adopted a smoke ordinance in 1881 and Cincinnati, the same year. An ordinance in St. Louis was promulgated in 1893. By 1912, 23 of the 28 cities with more than 200,000 population had smoke abatement programs. Today, we have air pollution control legislation in many cities. In a few areas, statewide control has been written into law.

Unfortunately, in a few instances, air pollution nuisances have led to hysteria. Some of this hysteria has been reported in the public press and has sponsored hastily acting legislation, *not supported by facts.* Such statutes will not end atmospheric pollution the minute they are assigned into law. We have examples of air pollution legislation now in force that do not work and can never be made to work unless the entire philosophy is changed so that their administration can be conducted on a sound and proper basis. The type of legislation referred to is that of the "big stick," which says that there will be no air pollution as of now and anyone found guilty is subject to prosecution.

Air pollution control does not work that way. Air pollution can not be turned off as if you were throwing an electric switch. An example of a sound legislation is that existing in the state of New Jersey. The writing of the act occupied four years and resulted from the thinking of many persons representing the private citizen, municipal government and industry before it was enacted into a law.

This legislation establishes a commission with the power to study the situation in New Jersey and then promulgate or repeal codes, rules and regulations. The administration of these rules is by the State Department of Health who have the staff, the trained personnel, the scientific equipment, the laboratories and the background of knowledge gained through many years of work in this field.

The law states that before any code is promulgated, there is to be held public conferences where discussion occurs as to whether or not a proposed code is needed. If it happens that a code is needed then a proposed code is drafted and a public hearing is held.

At these public hearings, briefs are received from the interested persons that reflect their opinions concerning the wording of such a code. Once the proper wording of the code has been determined, it is advertised throughout the State and finally adopted. But the effective date is still some distance in the future.

The Health Department may spend up to a year, as it is required in the law, in the process of persuasion, consultation and conciliation in order to give sufficient time to work out air pollution control when it is necessary. Only after all such procedures fail to bring about control and after a problem is studied and fully documented will it become a matter of litigation between the state and the individual. Even so, the final determination of reasonableness in an air pollution situation remains in the hands of the court. No existing civil or criminal remedy for any wrongful action which is a violation of any code is excluded or impaired by the law.

Legislative action against air pollution is here to stay on Federal, State and local levels. Burdensome legislative air pollution control machinery is unnecessary but the type of legislative machinery that provides first for study, for education and for cooperation in the absence of politics and where common sense is the rule, is the only successful legislative prescription with any promise of success. ▲▲